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Report Documentation Page			Form Approved OMB No. 0704-0188		
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1. REPORT DATE 2006		2. REPORT TYPE		3. DATES COVERED 00-00-2006 to 00-00-2006	
4. TITLE AND SUBTITLE Improving the Development and Utilization of Air Force Space and Missile Officers			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S)			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Rand Corporation,1776 Main Street,PO Box 2138,Santa Monica,CA,90407-2138			8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES 203	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

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Improving the Development and Utilization of Air Force Space and Missile Officers

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Prepared for the United States Air Force

Approved for public release; distribution unlimited



PROJECT AIR FORCE

The research described in this report was sponsored by the United States Air Force under Contract F49642-01-C-0003. Further information may be obtained from the Strategic Planning Division, Directorate of Plans, Hq USAF.

Library of Congress Cataloging-in-Publication Data

Improving the development and utilization of Air Force space and missile officers /
Georges Vernez ... [et al.].

p. cm.

Includes bibliographical references.

"MG-382."

ISBN 0-8330-3818-4 (pbk.)

1. United States. Air Force—Officers—Training of. 2. Astronautics, Military.

I. Vernez, Georges.

UG793.I52 2005

358'.8'0973—dc22

2005018903

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Published 2006 by the RAND Corporation

1776 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

1200 South Hayes Street, Arlington, VA 22202-5050

201 North Craig Street, Suite 202, Pittsburgh, PA 15213-1516

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Preface

In 2001, the Vice Commander of the Air Force Space Command (AFSPC/CV) asked the RAND Corporation to review the assignment and utilization of space and missile officers (Air Force specialty 13S) and assess whether the career field is sustainable. About the same time, the Commission to Assess United States National Security Space Management and Organization issued a report calling for significant changes in the development and management of the space workforce, including officer, enlisted, and civilian personnel (Rumsfeld Space Commission, 2001). Before and at the same time as our research, the so-called Developing Aerospace Leaders initiative was formulating ideas for altering professional development of Air Force officers within and across career fields.

Seeking common ground between somewhat competing initiatives (the Developing Aerospace Leaders initiative aimed to counter the tendency for officers to stay within narrow functional communities and instead broaden them into other areas to increase their future effectiveness as Air Force leaders, while the Rumsfeld Space Commission mandated greater depth for space professionals), we concentrated first on identifying requirements: the backgrounds that 13S officers need to perform their jobs successfully—i.e., the demand. At the same time, we examined the backgrounds that officers had actually acquired by different stages in their careers—i.e., the supply. Then, we assessed the gaps in officers' preparation and, finally, developed and used an optimization model to assess whether altered patterns of officer development and utilization could improve the match between

supply and demand and be sustained over time. As we illustrate, the model can address both current and future sets of requirements.

This research, completed in early 2003, should be of interest to leaders in the space and missile community for what it says about the development and utilization of 13S officers, to leaders in other operational and functional communities and to personnel planners for its potential methodological applicability to other career fields and even across career fields, and to personnel, education, and training specialists for the kinds of data it uses and the new analytic capability it presents.

Subsequent to the completion of this research, the Air Force space and missile community established a Space Professional Development Program at AFSPC to oversee the development of officer, enlisted, and civilian space professionals Air Force-wide and published *Space Professional Strategy*, a strategic plan for developing and sustaining the officer, enlisted, and civilian space workforce (AFSPC, 2003). With assistance from its contractor, Scitor Corporation, the program ("Space Pro") has developed more extensive databases that parallel those assembled and demonstrated in this preliminary research: one designates each position's requirements, another identifies its contribution to an incumbent's experience portfolio, and a third describes each member's accumulated portfolio of experience—all three in terms of what are called *space professional experience codes* (see AFSPC, 2005). In parallel, the Chief of Staff, Gen John Jumper, and the Secretary of the Air Force, Robert Roche, began "operationalizing" the Developing Aerospace Leaders initiative. They adopted a conceptual framework, chartered development teams to help shape plans for career fields and guide members' deliberate development under the leadership of long-standing functional managers, established staffs at the Air Staff and the Air Force Personnel Center to support the effort, and appointed a Force Development Council of senior leaders to oversee the overall force development enterprise.

This research was sponsored by the AFSPC/CV and was conducted in the Manpower, Personnel, and Training Program of RAND Project AIR FORCE. Coauthor (then-Lieutenant Colonel)

Jeff Yuen, a 13S officer, spent the 2001–2002 academic year at RAND in his assignment for Senior Service School.

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Contents

Preface iii

Figures xi

Tables xiii

Summary xvii

Acknowledgments xxix

Abbreviations xxxiii

CHAPTER ONE

Introduction 1

The Space and Missile Career Field (13S) 1

Concerns About the Evolution of the Career Field 4

Research Objectives and Approach 5

Scope and Limitations 7

Organization of This Report 8

CHAPTER TWO

Backgrounds Required for Space and Missile Jobs: Demand 9

Identifying 13S Jobs’ Required Backgrounds 9

 Focus on Education, Training, and On-the-Job Experience 9

 Experts Identified the Jobs’ Requirements 11

 Reliability of the Experts’ Ratings of Required Backgrounds 14

 Assessment of the Rating Process and Limitations 17

Backgrounds Required for 13S Jobs 18

 Backgrounds Demanded 19

 Demand for Tactical Experience 21

Demand for Technical Education	22
Combinations of Backgrounds Needed for 13S Jobs	23
Backgrounds Needed for O-4 Positions	24
Backgrounds Needed for O-5 Jobs	27
Backgrounds Needed for O-6 Jobs	29
Conclusions	31

CHAPTER THREE

Space and Missile Officers' Backgrounds and Career

Paths: Supply	33
Identifying Officers' Backgrounds	33
The AFPC Historical Data File	33
Translating Positions Held to Backgrounds Acquired	33
An Illustrative Career History	35
Limitations	35
Incumbents' Backgrounds	37
Availability of Specific Backgrounds	37
Technical Education	40
Tactical Operational Experience	42
Depth of Tactical Operational Experience	43
Career Development	46
Framework for Describing Career Paths	47
Opportunities for Career Development	48
Individual Career Paths	49
Career Experience Acquired Over Time	51
Aggregated Career Paths	53
Differences in Career Development Between Space and Missile Officers	57
Conclusions	59

CHAPTER FOUR

Gaps Between Supply and Demand	61
Specific Backgrounds in Short Supply	61
Air Force Specialty Prefixes: R, S, and W	62
Functional Experience	64
Organizational Experience	64

Technical Education	64
Operational Experience	65
Combinations of Backgrounds in Short Supply	65
Gaps in Combinations of Backgrounds for O-4 Jobs	68
Gaps for O-5 Jobs.....	70
Gaps for O-6 Jobs.....	72
Assignment of Officers to Jobs Contributes to the Mismatch	
Between Supply and Demand	72
Process of Assigning Officers to Jobs	72
How the Backgrounds of Incumbents Compare with Those	
the Jobs Need	74
Conclusions	77

CHAPTER FIVE

Modeling 13S Officer Development and Utilization	79
Conceptual Overview	80
Operationalizing the Model	80
Retention Rates, Accession, and Job Durations	81
Number of Jobs at Each Grade	83
Set of 12 Backgrounds	83
Groupings of Jobs.....	86
Key Assumption	88
The Optimization.....	89
Mathematical Expression of the Optimization Model.....	89
Outputs	91
Model Uses and Limitations	92

CHAPTER SIX

Improving Officer Development and Utilization	95
Gaps Remain, Even Though Types of Experience Are Aggregated	95
Five Optimization Cases	97
Case 1: Optimization	97
Case 2: Optimization, Ladders, and <i>Depth</i>	98
Case 3: Optimization, Ladders, and <i>Breadth</i>	99
Case 4: Further Integration of Warfighting and Acquisition	99

Case 5: Weaponization of Space and Civilianization of Some
Support Activities 100

Effects on Workforce Development 101

 Comparing Aggregate Experience Growth 101

 Comparisons with Respect to Combinations of Experience 107

 Comparing Person-to-Job Matches 112

Conclusions 117

CHAPTER SEVEN

Conclusions and Recommendations 121

Conclusions 121

Recommended Next Steps 124

 Refining the Results and Addressing the Needs for Additional
 Space Professionals 124

 Adapting the Approach for Other Occupations, and Across
 Career Fields 126

 Extending and Improving the Analytic Methods 127

References 129

Enclosed CD-ROM¹

APPENDIX

A. 13S and Non-13S O-4, O-5, and O-6 Positions A-1

B. Background Rating Form and Instructions B-1

C. 13S Officers: Selected Characteristics C-1

D. Trends in 13S Officers' Acquired Backgrounds,
1986–2000 D-1

E. 13S Job Groups for Flow Modeling E-1

F. Case 2 Inventory F-1

G. Summary Tabulations Comparing Five Optimizations G-1

¹ Note that, to accommodate the oversized tables, all the appendixes are supplied only on the enclosed CD-ROM.

Figures

3.1. Percentage of 13S Core Officers by Type of Technical Education, 2001	41
3.2. Distribution of 2001's 13S Core Officers, by Type and Combination of Operational Experience and by Grade	44
3.3. Percentage of 2001's 13S Core Officers, by Length of Operational Experience and Average Time in Specific Mission Area and by Grade	45
3.4. Career Dimensions and Experience Used to Describe the Career Paths of 13S Core Officers	48
3.5. Opportunities to Acquire Experience, by Career Dimension	49
3.6. Actual Career Paths of Two 13S Core Officers.....	50
5.1. Officer Flows in 13S Career Optimization Model	81
6.1. Differential Growth in Categories of Experience, 2001 Inventory.....	102
6.2. Differential Growth in Categories of Experience, Case 1: Initial Optimization.....	102
6.3. Differential Growth in Categories of Experience, Case 2: Optimization, Ladders, and <i>Depth</i>	103
6.4. Differential Growth in Categories of Experience, Case 3: Optimization, Ladders, and <i>Breadth</i>	103
6.5. Differential Growth in Categories of Experience, Case 4: Integration of Warfighting and Acquisition—Future Option 1	104

6.6.	Differential Growth in Categories of Experience, Case 5: Weaponization of Space and Civilianization of Some Support—Future Option 2	104
6.7.	Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: 2001 Inventory.....	109
6.8.	Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: Case 1	109
6.9.	Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: Case 2	110
6.10.	Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: Case 3	110
6.11.	Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: Case 4	111
6.12.	Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: Case 5	111
6.13.	Shares of Incumbents Lacking One or More Types of Prior Experience Needed for Their Jobs	113
6.14.	Jobs' Utilization of Officers' Accumulated Experience	116
6.15.	More-Demanding Jobs Come Later in Each Grade (Case 2) ...	117
6.16.	First Jobs at O-4 and O-5 Bring Many New Types of Experience (Case 2)	118
B.1.	Rating Form	B-2
B.2.	Instructions for Completing Rating Form	B-3

Tables

1.1.	Authorized 13S Duty Positions, by Shred and by Grade	3
2.1.	13S AFSC O-4, O-5, and O-6 Positions, by Organization	12
2.2.	Jobs Rated Critical, Important, Useful, or Needed, by Rater	15
2.3.	13S Jobs Requiring Specified Backgrounds, by Grade	20
2.4.	13S Jobs Needing Each Type of Prior Tactical Experience, by Grade	22
2.5.	13S Jobs Requiring Technical Education, by Type	23
2.6.	13S O-4 Jobs Needing Specific Combinations of Backgrounds	25
2.7.	13S O-5 Jobs Needing Different Combinations of Backgrounds	28
2.8.	13S O-6 Jobs Needing Different Combinations of Backgrounds	30
3.1.	Experience a 13S Colonel Acquires Over the Course of His or Her Career	36
3.2.	13S Core Officers with Specified Backgrounds, by Grade	38
3.3.	How O-5 and O-6 13S Core Officers Had Acquired Operational Experience	43
3.4.	Average Years of Operational Experience by System Type and by Grade	46
3.5.	13S Core Officers with Specified Experience and Amount, by Career Dimension and Grade, 2001	52
3.6.	Most Frequent Combinations of Aggregated Career Dimensions Acquired by 2001's 13S Core Officers, by Grade	55

3.7.	Retention Rates of Officers, by Year, Cohort, and Type of First Operational Experience	58
4.1.	Gaps Between Experience FY 2001 13S Officers Had Acquired and What 13S Jobs Need.....	62
4.2.	Comparison of 13S Officers With and 13S Jobs Requiring a Technical Education, by Type and by Grade	66
4.3.	Comparison of 13S Officers With and Jobs Requiring Operational Experience, by Mission and Grade	67
4.4.	Gaps Between What 13S O-4 Officers Have and What 13S O-4 Jobs Need	69
4.5.	Gaps Between What 13S O-5 Officers Have and What 13S O-5 Jobs Need	70
4.6.	Gaps Between What 13S O-6 Officers Have and What 13S O-6 Jobs Need	71
4.7.	Jobs for Which Incumbents' Backgrounds Met Job Requirements	74
4.8.	Jobs for Which Incumbent Officers Have the Background Needed for the Job	76
5.1.	Average Stage (Job) Durations and Retention Rates.....	82
5.2.	13S Positions Available at Each Grade	83
5.3.	Consolidation of Specific Experiences into 12 Categories.....	85
5.4.	13S Jobs Demanding or Offering Selected Background, by Grade	86
5.5.	Experience Profiles Possible at Successive Career Stages, by Grade and Career Stage.....	88
6.1.	Jobs for Which Prior Experience Was Needed but Lacking, by Category of Experience and Grade, 2001	96
6.2.	Percentage More Time: Case 2 (Optimization, Ladders, <i>Depth</i>) Officers Than Case 3 (Optimization, Ladders, <i>Breadth</i>) Officers Spend Acquiring Each Category of Experience, by Grade	106
6.3.	Percentage of Jobs Needing Each Experience with Incumbents Lacking That Experience, 2001	115
A.1.	13S O-4 to O-6 Officers Filling Non-13S Duty AFSC Positions at End of 2001, by Duty AFSC	A-1

A.2.	O-4 to O-6 Positions in 2001 Rated for Their Requirements, by Command and by Shred.....	A-1
B.1.	List of SMC Positions Provided to Experts	B-5
B.2.	Percentage of Positions in Which Raters Agreed About the Importance of Each Item	B-6
B.3.	Comparison of Percentage of O-4, O-5, O-6 Positions Requiring Specified Backgrounds in Original and Reviewed Ratings	B-8
C.1.	Retention Rate of the 1975, 1980, 1985, 1990 Cohorts of All Officers and of Officers with Technical Academic Degrees	C-1
C.2.	Percentage of Officers with a Technical Academic Degree at Entry in the Force, by Year of Entry.....	C-1
C.3.	Percentage of 13S Core Officers by Type of Operational Experience and by Grade, 2001	C-2
C.4.	Percentage of 13S Officers with Selected Backgrounds by Type of Operational Experience and by Grade, 2001	C-3
C.5.	Percentage of Officers Promoted by Grade, First Operational Experience Acquired and Cohort, 1975–1995	C-4
D.1.	Percentage of 13S Core Officers with Specified Backgrounds Prior to Entering Their Last Job, 2001	D-1
D.2.	Percentage of All 13S Officers with Selected Backgrounds by Year, 1986–2001	D-3
E.1.	Experience Gained and Experience Demanded by Group of Jobs.....	E-2
F.1.	Experience Accumulated by Officers by Grade and by Stages Within Grade	F-2
G.1.	Summary Comparison of Five Optimization Cases with 2001 Inventory.....	G-2

Summary

Numbering about 3,450 officers during 2001, the 13S career field (space and missile operations) in 1994 merged the separate space and missile career fields. While the nation's intercontinental ballistic missile force has shrunk substantially during the service of many of today's officers, the space-based systems for navigation, surveillance, warning, and communication have become more numerous. Although missile jobs remain more numerous for junior officers, increasingly more space-oriented jobs are becoming available for mid- and senior-level officers. While missile operations generally follow detailed and rigid standard operating and safety procedures, space system operations are more varied and flexible, although they have also grown more standardized and routinized.¹ Finally, civilians (often contractor personnel) play significant roles for space systems but not in missile operations.

AFSPC has issued inconsistent career guidance to 13S officers, once recommending experience across all five categories of operations and systems—missile combat crew, satellite command and control, launch (also called *spacelift*), surveillance, and warning—and later recommending only a “major” and a “minor” area of mission exper-

¹ The Commission to Assess United States National Security Space Management and Organization's 2001 report recommended realigning the space-oriented portion of the workforce along earlier lines, in which teams of scientific, engineering, and acquisition specialists helped design, develop, test, acquire, and operate space systems, succeeding substantially on the basis of technical expertise, innovation, experimentation, and adaptation—almost the antithesis of relying on standardized procedures. The commission is also referred to as the Rumsfeld Space Commission, the term we will use in the remainder of this monograph.

tise. AFSPC leaders have wondered whether the career field is so diverse and unbalanced that it may not be sustainable. In 2001, the Rumsfeld Space Commission decried a lack of experience among space officers; raised the possibility of creating a separate space corps; called for intensified, career-long education and training for space professionals; and mandated “specific criteria . . . for the selection, training, qualification and assignment of space personnel who will design, develop, acquire and assess military space systems.”

To help address these issues and the adequacy of the overall assignment and development of 13S officers, this research (1) identified the backgrounds that 13S officers should have (the demand, now and potentially in the future), (2) assessed the backgrounds today’s officers possess (the supply) and the career paths they have followed, (3) measured the gaps between the demand and supply, and (4) modeled potential development and utilization patterns to see whether stable policies and sustained flows could match the supply more closely with the demand, allowing the Air Force to establish and promulgate corresponding and specific career guidance, now and in the future. The short answer is “yes.”

Identifying the Backgrounds Needed (Demand)

Instead of concentrating on underlying competencies (knowledge, skills, and abilities) that space and missile officers should possess, we collected information about the specific education, training, and work experience that are important for performing different groups of 13S jobs satisfactorily.² AFSPC asked senior 13S officers, expert in

² We use education, training, and work experience as *proxies* for sets of competencies. It is easier to rate their importance for job performance; they are observable in officers’ personnel records; and they can be used in career-path management. Of course, the mere completion of education and training courses or of specific kinds of assignments does not guarantee development of the targeted, but implicit, competencies. The Air Force still must evaluate individual performance, professional development, suitability for command, and schooling and base critical assignments and promotion on officers’ demonstrated competencies. Deliberate development can provide the opportunities to develop and demonstrate necessary competencies, but it cannot substitute for them.

each organization and/or functional area, to rate the importance of 70 specific backgrounds for satisfactorily performing about 1,100 jobs authorized at the grades of major (O-4), lieutenant colonel (O-5), and colonel (O-6). The specific backgrounds are in eight categories:

- **mission operations**, such as missile combat crew, satellite command and control, and either space or missile operations
- **special experience**, such as instructor, standardization and evaluation examiner, safety officer, and weapons and tactics instructor³
- **functional experience**, such as assignments in current operations, plans and programs, acquisition, and requirements
- **organizational experience**, such as jobs in the Air Staff, Headquarters AFSPC, the National Reconnaissance Office, the Air Intelligence Agency, and U.S. Space Command
- **command**, such as command of a squadron, operations group, wing, or center
- **academic education**, such as having an undergraduate or graduate degree in science, engineering, or business or having taken specific professional military education courses
- **training**, such as having taken Air Force advanced technical courses in space operations
- **pay grade**, that is, whether the officer must hold the grade authorized for the job.

Each expert (mostly colonels) rated each background as critical, important, useful, or not needed for each of about 20 to 40 jobs within his or her purview, out of a total of 1,092 O-4 through O-6 jobs for 13S core officers. The raters could also target a minimum amount and desired recency for each item.⁴

³ These are the jobs that carry specialty prefixes—K, Q, S, and W, respectively, in the examples.

⁴ The instructions that guided them and the questionnaire they used are in Appendix B. In almost all cases, a member of RAND's research staff met with the respondent to help explain the objectives and process, answer questions, and monitor the assessment of at least the first few jobs. In a few cases, this had to be done via telephone. For about 420 jobs, AFSPC's 13S

We consolidated the raters' responses to reflect 56 different backgrounds. An average of 5.0 items per O-4 job had been rated critical or important, with averages of 6.2 and 10.4 for O-5 and O-6 jobs, respectively. Some jobs were rated as needing as many as 25 of the 56 backgrounds, and some were rated as needing none at all. Three panels of colonels reviewed and revised these statements of requirements, concentrating on missile jobs, space jobs, and acquisition jobs, respectively.

The raters considered tactical experience in space or missile operations to be critical or important for about 90 percent of the jobs above O-3. Although they specified a particular type of tactical experience as being *preferred* for more than 40 percent of the jobs, any other sorts of space or missile experience often would be acceptable if no one with the specific (preferred) experience were available. Indeed, the raters found specific experience to be *necessary* for only about 15 to 20 percent of the jobs. The background most frequently preferred was missiles—for about 20 percent of the jobs in each grade—but it is actually necessary for only about half as many. For nearly a third of the jobs, experience in any of the space mission areas would suffice; for nearly half, a background in either space or missile operations would be adequate. Fewer than 5 percent of the jobs in each of the three grades above O-3 need experience in a specific space mission (see pp. 21–22).

The other backgrounds identified as needed most often are organizational experience at AFSPC headquarters, the Air Staff, the wing and group levels, and in the joint community; technical experience as instructors and in standardization and evaluation; and functional experience in current operations, plans and programs, requirements, test and evaluation, and acquisition. Command experience is frequently important for O-6 jobs. Technical academic degrees, primarily in engineering, were rated as critical or important for only about 10 to 12 percent of the jobs at O-4 and O-5 and for about 20

assignment officers identified the backgrounds needed based on recent requisitions for new or replacement officers.

percent of those at O-6. Professional military education and technical military training were seldom marked as needed (see pp. 20–21).

Using statistical cluster analysis, we identified groups of jobs that need similar backgrounds, regardless of which organizations “own” the jobs. Some groups need experience in missiles, acquisition, and plans and programs, for example, and others need satellite command and control, current operations, and joint experience (see pp. 23–30).

The Air Force could use such information to match individual officers to individual jobs and to develop the force proactively to ensure that officers in the space and missile field actually acquire the backgrounds its jobs need.

During the lengthy period it took to collect the requirements data, we worked with participants in Air Force meetings and several integrated product teams that developed ideas and material to create and support the Space Professional Development Strategy in response to the Rumsfeld Space Commission. These interactions yielded valuable insights into potential future changes in requirements—e.g., more officers who understand both the acquisition and warfighting aspects of space systems, possible “weaponization” of space operations (i.e., using space vehicles as platforms for active defense or offense, not only for supporting air and surface operations by others), and further civilianization or outsourcing in such support areas as budgeting, education, and training.

Assessing Officers’ Backgrounds (Supply) and Career Paths

For the 3,436 members of the “space core” at the end of FY 2001, we discerned each officer’s accumulated backgrounds, from year-end personnel records covering 1975 through 2001. We used organization codes, function codes, duty titles, locations, duty Air Force specialty codes, and pay grades to translate each year-end observation into

terms consistent with the requirements defined by the experts.⁵ The older the data, the more difficult and, in some cases, the less complete the translation. Even so, we believe we identified most of the relevant education, training, and experience that 13S core officers active in 2001 had acquired. Because some types of experience were unavailable in earlier years—e.g., space and missile officers first held jobs with the R prefix (contingency and war planner) in 1995, and only a handful held jobs with the W prefix (weapons and tactics instructor) before 1996—they are missing from older officers' portfolios.⁶ This analysis covered grades O-1 through O-6, not only the top three.

As expected, officers' backgrounds expand through their careers: Among the same 56 background items for which the jobs' demands were summarized, 2001's first lieutenants had acquired an average of 1.9 items; captains, 4.8; majors, 8.6; lieutenant colonels, 11.0; and colonels, 13.5.⁷ Across the grades, 71 to 90 percent of the officers had missile experience, and 33 to 55 percent had technical academic degrees (see pp. 38–39).

As the numbers of space jobs and organizations have grown over time, more officers have gained operational experience in space systems, but older officers have often gained their space experience as commanders rather than as crew members. More than one-half the colonels with space operational experience first acquired it as commanders, as did one-fourth to one-third of the lieutenant colonels. But this will change as younger officers advance to the higher ranks. On average, officers had spent five to six years in missile operations, three to four years in satellite command and control operations, and two or fewer years in other space mission areas (see pp. 40–46).

⁵ RAND developed the rules for this translation in collaboration with a senior 13S Air Force Officer.

⁶ Using the same rules of interpretation, we also tracked the backgrounds of some 3,500 officers who were no longer in the space core in 2001—i.e., who had left the Air Force or transferred to other core occupations.

⁷ The 8.6, 11.0, and 13.5 averages for O-4, O-5, and O-6 officers are notably larger than the numbers of items rated either critical or important for the jobs at those grades (5.0, 6.2, and 10.4, respectively).

To represent career paths, we separated jobs into nine classes, or “aggregate career dimensions,” then grouped these together for comparison, as follows:

- force employment and operations against support and staff
- strategic against operational against tactical scope
- command jobs against other jobs.

We further subdivided many of these classes of jobs according to the type of system or function, ending with 36 categories of career experience. The more detailed the categorization of jobs, the more career paths that are distinguished, and the fewer officers who have followed each path. In any case, the higher the grade, the more paths officers have followed. By the end of captaincy, officers had followed 18 different career paths, with 180 officers following the most numerous path and as few as seven following the tenth most numerous path. In contrast, the 156 colonels active in 2001 had followed 55 different career paths; 22 had followed the most numerous path, and five had followed the tenth most numerous path. Two of three colonels had acquired either four or five aggregate career dimensions when they were promoted; about one in eight had only three; and only 1 percent had all seven (see pp. 53–57).

Beyond the accumulation of specific types of experience, the historical data show somewhat higher retention rates for officers with initial operational experience in missiles, compared with those who started in space. But promotion rates for the two sets of officers have been about the same. And although fewer officers in the higher grades have degrees in engineering and the physical sciences, retention rates have actually been similar between 13S officers with or without technical degrees. The Air Force simply took in fewer officers with technical degrees in earlier years (see pp. 57–58).

Measuring Gaps Between Demand and Supply

Considering each grade’s officers as a whole, plenty of 2001’s officers in the grades above O-3 had most of the targeted backgrounds—

technical degree; experience in the various operational mission areas, as instructors, and as commanders; and experience in current operations, logistics, and plans and programs, for example—although too few had experience as contingency and war planners; in safety, intelligence, or acquisition; or in a numbered air force (see pp. 61–64). Shortages were somewhat larger when backgrounds are considered in combination. Combinations in greatest shortage usually included several kinds of experience, typically backgrounds in current operations and one or more functional areas (typically acquisition, requirements, and/or test and evaluation), the National Reconnaissance Office or the Space and Missile Center, a major command and/or a higher headquarters (Air Staff, Office of the Joint Chiefs Staff [OJCS], or Office of the Secretary of Defense [OSD]), and technical education. It is very difficult for officers to accrue that many backgrounds before becoming lieutenant colonels, so the Air Force might consider either shifting some of the O-4 jobs that demand many types of experience to a higher grade or reevaluating the need for this targeted breadth of experience (see pp. 68–72).

Gaps between the experience jobs needed and what officers had were far greater at the individual person-and-job level, where they really count. For about 90 percent of the jobs above O-3 that needed an officer with certain experience, the incumbent in 2001 lacked one or more of the needed types of experience. Most often missing were experience as a weapons and tactics instructor (W prefix) and a war planner (R prefix), in certain functional areas (politico-military, communications, intelligence, research and development, acquisition, requirements, and test and evaluation) and in certain organizations (Air Force Operational Test and Evaluation Center, Defense Threat Reduction Agency, OJCS or OSD, and a numbered air force). Even operational experience in space or one of the specific space missions frequently was missing. Too many assignments may be made without enough regard for either the job's background requirements or the officer's needs for additional experience to prepare for future jobs (see pp. 73–76).

Improving Space and Missile Officer Development and Utilization

We developed an optimization framework to identify paths that would develop and utilize officers (via assignments) more deliberately, e.g., by using a grade's less-demanding jobs to give officers the experience needed for more-demanding jobs scheduled later.

The aim for the optimization was to prepare and assign officers at each career stage so that their backgrounds would meet or exceed their jobs' needs. It uses a scoring scheme that awards points each time an incoming officer brings a type of experience regarded as critical or important for his or her new job. To limit the model's size, we consolidated most of the backgrounds considered in the earlier analysis of demand and supply into 12 categories.⁸ For example, experience in satellite command and control, spacelift, surveillance, or warning became "space operations experience"; experience in acquisition, research and development, test and evaluation, or at the Air Force Operational Test and Evaluation Center or the Space and Missile Center became "acquisition experience"; and experience at OSD, OJCS, or a unified command became "joint experience." Even using these aggregated categories (and assuming that backgrounds within a category substitute for each other), the officer force in 2001 still exhibited substantial person-to-job mismatches. For example, 58 percent of those in jobs needing a background in acquisition lacked it; the numbers were 74 percent for requirements, 53 percent for Joint Staff, and even 21 percent for space operations. Compared with a perfect score of 100 percent if each incumbent had experience in all the categories his or her job needed, 2001's officers scored 63 percent (see pp. 95–96).

We used the optimization to find ways to "flow" officers through jobs that would increase the match to 99.5 percent and leave fewer than 4 percent of the jobs with incumbents who lacked even one targeted type of experience. The few remaining shortfalls would be for experience as a commander, in planning and programming, or

⁸ These categories were identified and agreed to in cooperation with staff at AFSPC.

as a technical leader and would be almost entirely at grade O-4.⁹ Officers following optimized development and utilization patterns would exhibit only about half as many different experience profiles as we observed among 2001's officers. While it would be impossible in practice to manage officer flows as precisely as the model proposes, these results demonstrate the potential for greatly improving person-to-job matches in the 13S career field, for stabilizing and sustaining officer flows, and for targeting limited numbers of development and utilization patterns.

Assessing Policy Options

Because many different development and utilization patterns would do equally well in meeting the jobs' background needs, the model can be guided using additional objectives. To illustrate, we used three cases that we based on 2001's jobs and their associated requirements for experience:

- Case 1 simply maximizes the match score.
- Case 2 maximizes the match score; places as many officers as possible (42 percent) on a missile, space, or acquisition ladder by the time they complete eight to nine years of service; and builds technical depth by concentrating officers' careers in fewer experience categories.
- Case 3 is like Case 2 except that it favors breadth over depth, working to give officers experience in many categories.

Case 1's results generally fall between those of Case 2 and Case 3. The average length of experience in some background categories would be up to 50 to 60 percent greater in Case 2 than in Case 3 and roughly 15 to 45 percent greater than for the force in 2001 (see pp. 101–105).

⁹ A *technical leader* is defined as having had a job at group or wing level with the instructor (K) or standardization and evaluation examiner (Q) prefix.

Two additional cases examined possible future changes in requirements:

- Case 4 (further integration of warfighting and acquisition) is like Case 2, except that experience both in acquisition and on a joint staff are regarded as important for command jobs, elevating the targets for 199 jobs and raising the perfect match score by 10 percent.
- Case 5 (weaponization of space and civilianization of some support activities) is like Case 2, except that the numbers of jobs of different types have been changed, resulting in a net increase of 15 percent in 13S officers.

The optimization found flows for Cases 4 and 5 that would also exceed 99 percent of the perfect match scores, but the numbers of officers on a missile, space, or acquisition track and the force's overall depth of experience would be somewhat less than for Case 2 (see pp. 106–107).

Along with almost complete coverage of the jobs' needs would come considerably higher utilization of officers' experience: 66 percent, 69 percent, and 72 percent for O-4s, O-5s, and O-6s in Case 2, for example, compared with only 31 percent, 37 percent, and 49 percent in 2001, respectively (see pp. 115–116). The more their experience matches the jobs they fill, the more productive officers should be than others, the more satisfied they may be with their jobs and careers, and the more likely they will expect the Air Force to continue their deliberate development and utilization.

Conclusions and Recommendations

In 2001, although adequate numbers of each grade's 13S officers (in grades above O-3) possessed most of the needed backgrounds, these officers did not necessarily possess them in the right combinations; many lacked backgrounds needed for their jobs; and many were in jobs that did not make good use of their backgrounds. Our modeling work shows that the match between the types of experience jobs need

and those of incoming officers can be improved substantially, that career tracks can be established allowing concentrations on missile or space operations or on acquisition, that officers' depths of experience can be increased in many areas, that development and utilization patterns can be stabilized and sustained, and that limited adjustments can accommodate potential changes in future requirements. To achieve these goals, the Air Force's assignment process must increase its emphasis on deliberate development and utilization of officers' experience, working to encourage the development of particular combinations of qualifications and increased utilization of their backgrounds.

In particular, we recommend the following:

- AFSPC leaders and the 13S career-field management staff should refine the development and utilization patterns that this research has identified, work with the Air Force Personnel Center and the relevant commanders and supervisors to coordinate the officer-assignment system in pursuit of the targeted patterns, publish revised career-field guidance, and consider extending the approach to enlisted and civilian space professionals (see pp. 124–126).
- The Air Force personnel community and functional managers should adapt this approach for selected other career fields and even across career fields (see pp. 126–127).
- The analytic framework should be extended—e.g., to increase flexibility in making assignments (by increasing selectivity, the numbers of individuals qualified and available to fill openings) and to reflect education and training as well as work experience (see pp. 127–128).

Acknowledgments

We are grateful to many people who helped guide and support this research. In particular, we acknowledge the late Lt Gen Roger DeKok, who identified the need for the study, and Lt Gen Bob Hinson, his successor, who made sure we received the help needed to complete the work.

We also thank Col Mark Lilevjen (retired) and Maj Scott Russell in AFSPC/XOT and Maj Doug Harler in AF/XOS, who helped design the survey instruments and arranged for us to meet with the senior officers who identified the backgrounds needed for the various space and missile positions. AFSPC/DP's Col Jim Burling (now retired) and Maj Ron Huntley also helped initiate the study. Col Dave Nuckles (AFPC) provided access to assignment officers knowledgeable about the requirements of 13S positions. Col Thomas Walker, Lt Col Daniel Jordan, and Maj Douglas Schiess (AFSPC/CVX) shared key insights about the future development of space professionals. Maj Gen Chuck Link (retired), Brig Gen Rick Lewis, Lt Col Jennifer Graham, and Maj Andrew Weirick (all of AF/DP-DAL) shared their knowledge about the goals and the intricacies of the Developing Aerospace Leaders effort and its relationship to the future development of space professionals.

The following officers contributed immeasurably to this work by rating the backgrounds needed in candidates for 13S jobs above O-3. Without them, there would have been no study:

Col Suzanne Vautrinot	14AF/A3
Col Edward Rausch	20AF/CV
Col Thomas Cullen	20AF/DO
Lt Col Tom Parker	21OG/CD
Lt Col John Emich	21OG/CD
Col Mark Owen	30OG/CC
Col Robert Worley	30SW/CC
Lt Col Michael Vaughn	319MS/CC
Col Kenneth VanSickle	381TRG/CC
Col Edward Rios	381TRG/CD
Capt Gregory Karahalidis	45OG/CCE
Col Diann Latham	50OG/CC
Lt Col Cary Chun	614OG/CC
Col Frank Gallegos	90OG/CC
Col Jeffrey Kwallek	90SW/CV
Maj James Griswold	ACC/DOTW
Lt Col Richard Lieber	AFSPC/CR
Col James Davis	AFSPC/DOM
Col Jon Hall	AFSPC/DOO
Col John Ward	AFSPC/DOS
Col Mark Lileyjen	AFSPC/DOT
Col Theresa Clark	AFSPC/DOY
Maj Paul Hamilton	AFSPC/DP
Col Katherine Roberts	AFSPC/DR
Col Richard Lucas	AFSPC/IGI
Col Charles Carpenter	AFSPC/XP
Col Tom Clark	AFSPC/XPP
Maj Paul Jampole	PACAF/DOIS
Col James Rodgers	SWC/DO
Maj John Moss	USAFE/DOTW
Lt Col Michael McGee	USSOCOM/SORR-SJO

Col Donald Knight	USSPC/J5S
Col Bob Servant	USSTRATCOM/J33
Col Robert (Bo) Reese	AF/XOXS
Col Brandy Johnson	SAF/AQSE
Col Brian Robinson	OSD/C3I
Col Carolyn Gavares	NRO/DP
Lt Col Andre Smith	DTRA/RMM
Col Dwight Rauhala	JCS/J5

Cols Jack Anthony, Allen Branco, Lloyd Keeton, James Mueller, Kathleen Oregan, Dwight Rauhala, Richard Strathearn, and Thomas Walker spent two days with us reviewing the requirements for more than 1,000 positions and pointed the direction for our future-oriented illustrations of the methodology.

Working with members of internal teams toward the USAF response to the Rumsfeld Space Commission helped us avoid many pitfalls.

At RAND, our colleagues Ray Conley, Richard Stanton, and Judith Mele contributed to all aspects of this work. Elham Ghashghai and Brent Thomas contributed especially to the creation and implementation of alternative optimization concepts.

We thank RAND colleagues Bart Bennett and Mahyar Amouzegar for their thoughtful technical reviews and suggestions for revisions that improved the document. Phyllis Gilmore's editing was also very helpful.

Finally, we appreciate the excellent secretarial and administrative assistance provided by Louis Ramirez, who typed many drafts and produced drafts of the graphics.

Abbreviations

13S	the Air Force space and missile career field
ACC	Air Combat Command
AETC	Air Education and Training Command
AF/DP	Air Force Headquarters, Deputy Chief of Staff for Personnel
AF/XO	Air Force Headquarters, Deputy Chief of Staff for Air and Space Operations
AF/XP	Air Force Headquarters, Deputy Chief of Staff for Plans and Programs
AFMC	Air Force Materiel Command
AFOTEC	Air Force Operational Test and Evaluation Center
AFPC	Air Force Personnel Center
AFS	Air Force specialty
AFSC	Air Force specialty code
AFSPC	Air Force Space Command
ALA	Air Intelligence Agency
AMC	Air Mobility Command
ANG	Air National Guard
B	squadron operations officer (specialty prefix)
C	commander (specialty prefix)
C ²	command and control

CAF	combat air force
CC	commander
DO	Directorate of Operations
DOT	Directorate of Training
DR	Directorate of Requirements
DTRA	Defense Threat Reduction Agency
FY	fiscal year
GAMS	General Algebraic Modeling System
HQ	headquarters
ICBM	intercontinental ballistic missile
K	instructor (specialty prefix)
MAJCOM	major command
NAF	numbered air force
NRO	National Reconnaissance Office
OJCS	Office of the Joint Chiefs of Staff
OSD	Office of the Secretary of Defense
OG	operations group
PME	professional military education
Q	standardization and evaluation examiner (specialty prefix)
R	contingency and war planner (specialty prefix)
R&D	research and development
S	safety officer (specialty prefix)
shred	subdivision of an AFSC by mission area
SMC	Space and Missile Center
SQ	squadron
SWC	Space Warfare Center
T	formal training instructor (specialty prefix)
T&E	test and evaluation

USAFE	U.S. Air Forces in Europe
USPACAF	U.S. Air Forces, Pacific Command
USSPACECOM	U.S. Space Command
USSTRATCOM	U.S. Strategic Command
W	weapons and tactics instructor (specialty prefix)
X	nonrated aircrew member (specialty prefix)
XP	Directorate of Plans and Programs
Y	analytic studies officer (specialty prefix)

Introduction

The U.S. military's role in space has evolved rapidly from initially emphasizing exploration to using space as a medium for force application (initially via missile trajectories); for information acquisition and transmission; for supporting air and ground operations; and, possibly in the future, as a base for launching military operations. As the diversity and complexity of space and missile missions increase, so will the education and career-development requirements of its officers.

This introduction describes the evolving space and missile career field, discusses key concerns of Air Force leaders and others about its evolution, and outlines our research objectives and approach.

The Space and Missile Career Field (13S)

The increasing number and broadening of space missions have brought periodic changes in space-related organizations, the division of functions among them, and the focus and composition of the space and missile career field.¹ The Air Force established the space operations career field (Air Force specialty 20XX) in 1970–1971 within the Strategic Air and Aerospace Defense commands. Initially, the field was small and populated by some newly commissioned lieutenants and crossovers from other Air Force career fields. Many came from the Air Defense Control field, with some from engineering and intel-

¹ For a more detailed history of this career field, see McLaughlin (2001).

ligence. When it was established in 1982, the Air Force Space Command (AFSPC) assumed control of the 20XX space career field and, eventually, of space operations in the Aerospace Defense and Strategic Air commands. In the late 1980s, AFSPC acquired additional functions as it absorbed the Air Force Satellite Control Facility and as remote tracking stations and the launch mission were transferred from the Space Division.

This consolidation led to important changes in the career field. First, it resulted in rapid growth. Second, the consolidation promoted integration of space activities with those in the rest of the Air Force. And it cemented the separation of space engineering and acquisition personnel from the career field. These personnel remained attached to the Air Force Materiel Command (McLaughlin, 2000, p. 13).

Finally, in 1994, the space and intercontinental ballistic missile career fields merged into a new career field, Code 13SXX. This doubled the career field's size. It also led to policy changes that affected requirements for entry into the field and incentives for career development that encouraged integration of the previous two career fields. The technical background that had been required for entry into the space career field was dropped for the new space and missile career field, and interflow was encouraged between the missile and space missions (McLaughlin, 2000, pp. 17–18).

Today, space and missile operations are divided into five mission areas, known as Air Force Specialty Code (AFSC) shreds: missile operations, satellite command and control (C²), spacelift operations, space surveillance, and space warning. The number of authorized positions differs significantly across these shreds and by grade. Missile crew positions (at the squadron or wing level) dwarf all other shreds, claiming 70 percent of the authorized positions in 2001 for first and second lieutenants. This share, however, decreases rapidly at captain and major, for which space positions constitute the larger share (Table 1.1). About 30 percent of 13S positions have no shreds, indicating no preference for mission backgrounds. These are senior staff positions, primarily at Headquarters (HQ) U.S. Air Force and HQ AFSPC and joint organizations.

Table 1.1
Authorized 13S Duty Positions, by Shred and by Grade (number)

Shred ^a	Grade					Total
	O-1/2	O-3	O-4	O-5	O-6	
C—Missiles	303	582	51	48	1	985
A—Satellite C ²	58	265	76	31	1	431
B—Spacelift	21	112	27	16	1	177
D—Surveillance	35	113	36	11	—	195
E—Warning	16	145	35	22	2	220
None ^b	1	158	432	209	57	857
Total	434	1,376	657	337	62	2,865

SOURCE: AFSPC authorization file (2001).

NOTE: All data as of fourth quarter FY 2001.

^aA *shred* is an area of specialization within the 13S AFSC. These are indicated by letter suffixes to the code, as noted here.

^bNo shred indicates no preference for specialization. Most positions above O-3 carry no shred.

Although the Air Force's *Officer Career Path Guide* states that there are "no definitive concrete steps (or squares to fill) to attain to reach rank or position," it nevertheless provides some guidance for officers' career paths (AFPC, undated p. 52):

- Gaining depth of technical expertise in a system is essential.
- Interflow between space and missile mission areas is encouraged.
- Company-grade officers are expected to remain at the squadron or wing level positions during their first 7 to 10 years of service.
- Upgrading to crew commander, instructor, evaluator, or flight commander is an important indication of the expertise and leadership required for future leadership positions.
- Every officer should strive to serve as an instructor in Air Education and Training Command (AETC) or their respective formal training unit early in their career.

This guidance pertains primarily to the first third of an officer's career. No further guidance is provided for subsequent years, other than that there are many staff billets at HQ AFSPC, HQ U.S. Air Force, major commands (MAJCOMs), numbered air forces, and

other agencies and that the path to a successful career “normally includes a strong technical base, solid staff experience, and challenging leadership positions” (U.S. Air Force, 2002). The Air Force’s recent *Space Professional Strategy* aims to reintegrate space engineering and acquisition personnel into the professional space force (AFSPC, 2003).

Concerns About the Evolution of the Career Field

Concerns about the career field and the development of individual officers are many. Foremost is the perception Air Force leaders have that the field is unsustainable, in part because it has been fragmented into many different shreds of different sizes. This fragmentation makes it difficult to achieve the balance of depth and breadth of experience needed to prepare leaders adequately for each mission area and for the space force as a whole. This concern was echoed in the report of the Commission to Assess United States National Security Space Management and Organization,² which concluded that the current approach to career development “builds space and missile career generalists, but inhibits the development of experts with specific mission area and weapons system expertise” and discourages “gaining breadth (including staff billet experience) within a particular space mission area” (Rumsfeld Space Commission, 2001, pp. 19–20). As a result, some officers leading space or missile squadrons lack experience in that particular mission area.

Another concern is the absence of information about the range of competencies that people in the space and missile career field need at each grade to perform the jobs they fill effectively. The Space Commission also echoed this concern, recommending that “criteria should be developed for the selection, training, qualification and assignment of all personnel who lead, operate, design, develop and acquire each of the nation’s national security space systems. *The crite-*

² For the sake of brevity, we will refer to this group as the “Rumsfeld Space Commission” throughout this report.

ria should encompass experience, education, and training milestones” (Rumsfeld Space Commission, 2001, p. 22; emphasis added).

A concern for individual officers is that they do not see clear career options because consistent guidance is lacking. This comes in part from frequent changes in the signals officers have received about their career development as changes in leadership have emphasized different priorities.

Research Objectives and Approach

This monograph aims to identify the experience, education, and training needed for 13S-duty AFSC jobs at grades of major, lieutenant colonel, and colonel, establishing benchmarks and evaluating the preparation of current 13S officers. The benchmarks can be modified to reflect potential changes in requirements due to expected future changes in space missions, technology, and/or force composition. To identify a set of career paths that meet specified job requirements at each career grade, we used a model that represents the flows of officers throughout their careers.

We took the following steps:

1. **Identify the experience, education, and training needed for space and missile jobs** (the qualifications the jobs demand)—Subject-matter experts (primarily colonels) rated the backgrounds needed for 1,092 O-4 to O-6 13S jobs, along with other, associated jobs, using a rating sheet listing 68 different types of missions and specialties (prefixes), and functional, organizational, leadership, academic, and training experience. These individuals rated each type of experience as critical, important, useful, or not needed for each job (or for job groups they regarded as similar). One can think of the resulting information as consistently written requisitions for personnel.
2. **Identify the experience, education, and training acquired by space and missile officers** (qualifications the officers supply)—We identified the experience that current core space and missile

officers had accumulated since entering the force, using the same terms as for the demand, from the Air Force Personnel Center's (AFPC's) end-of-year historical records from 1975 to 2001.³ One outcome of this task is a set of career paths followed by 13S core officers since 1975.

3. **Compare the qualifications the officers supply against the qualifications the jobs demand** (identifying gaps in officer preparation)—We made these comparisons for (1) each type of experience for the career field as a whole; (2) the combinations of experience, education, and training that jobs for the career field as a whole require; and (3) individual officers who filled 13S duty AFSC jobs in the year 2001. The first two comparisons assess the adequacy of officers' collective preparation for space and missile jobs. The last comparison adds an assessment of the assignment process that substantially governs that preparation and its utilization.
4. **Identify alternative career paths to improve the match between qualifications that space and missile officers acquire and those space and missile jobs demand**—We developed a model that simulates and optimizes the flow of 13S officers through jobs within and across grades. The model seeks to fill each 13S job with an officer possessing all the experience needed for the job. As officers fill jobs, they also acquire experience that carries forward to future jobs.
5. **Explore the implications for officer development of potential future changes in requirements**—In response to the Rumsfeld Space Commission's findings and recommendations, the Air Force developed a broad new concept for the development of space professionals. In this task, we explored the implications of a number of related strategic options for the development of the officer component of the space professional workforce.

³ In addition to the 13SXX officers on active duty in 2001, our historical file contains the career paths (at least the portions visible between 1975 and 2001) of all officers that have filled a 13SXX duty position in AFSC since 1994 or an 18XX (space) or a 20XX (missile) duty position in AFSC between 1975 and 1994.

Scope and Limitations

As noted above, this research concentrates on jobs within the immediate community of space and missile officers: 13SXX at grades O-4, O-5, and O-6 in AFSPC and other organizations within the Air Force and unified and joint commands and such closely aligned jobs as missile and space operations group commander (10C) and space wing commander (91W). Appendix A provides a list of the job distribution we studied, by AFSC, shred, organization, and grade.

Our scope was limited in a couple of ways. We did not identify job-specific requirements for O-4 to O-6 positions that are sometimes filled by 13S core officers and sometimes by officers from other specialties. In 2001, these included 73 operations staff officer positions (16G), 62 planning and programming positions (16R), 44 international political-military affairs positions (16P), 17 support commander positions (30C), 17 instructor positions (81T), and 17 commander positions (91C). Appendix A shows the distribution of 334 such non-13S positions that 13S core officers filled in 2001. While we did not identify the backgrounds needed for these jobs, our analysis accounts for the experience they provide officers and they are included in our modeling of career paths in Chapters Five and Six.

The exclusion of enlisted and civilian space and missile jobs and personnel is another limitation. The Air Force eventually should assess the experience, education, and training needed for these jobs and analyze corresponding career paths and developmental needs.

The reader should also keep in mind that the backgrounds identified as being needed by 13S jobs and those being acquired by the 13S officer workforce reflect the judgment of our panel of experts. Finally, we assessed whether enough officers develop the backgrounds needed for the jobs but did not assess whether the officers with the required backgrounds are proficient in their jobs. We further discuss these limitations in the relevant sections of the report.

Organization of This Report

The next chapter outlines how we identified the experience, education, and training needed for 13S jobs and documents these needs. Chapter Three documents the experience, education, and training that current active-duty 13S core officers bring to the jobs at each grade in their careers. Gaps in space and missile officer preparation are identified in Chapter Four. Chapter Five describes the key features of a flow model that seeks to optimize the development and utilization of officers, and Chapter Six illustrates how the model can be used to improve the match between officer preparation and the needs of jobs and to assess alternative officer preparation policies. Finally, Chapter Seven contains our conclusions and recommendations.

Backgrounds Required for Space and Missile Jobs: Demand

Identifying the backgrounds needed to perform the duties of space and missile 13S jobs is necessary before defining desirable career development and utilization patterns. The first section outlines how we defined backgrounds for space and missile jobs and then collected information on the backgrounds needed for more than 1,000 O-4, O-5, and O-6 jobs for 13S officers. The second section documents the backgrounds needed for the jobs.

Identifying 13S Jobs' Required Backgrounds

Focus on Education, Training, and On-the-Job Experience

We focused on academic background, professional military education (PME), and work experience as proxies for required competencies (knowledge, skills, and abilities) for two reasons. First, developmental theory observes that practice by actual application is the most important mechanism for developing tactical and strategic expertise; neither formal education nor self-development is sufficient.¹ Second, these backgrounds are concrete and identifiable in officers' administrative records and, hence, can readily be included in a personnel management and assignment system.

¹ For example, see Halpin (1995), Lambrecht et al. (1997), McCall (1998), and Stasz et al. (1993).

We specified the types of experience or background in these broad categories in terms relevant to the space and missile force, as follows:

- **Academics** includes undergraduate and/or graduate education, by academic area, with an emphasis on technical education (e.g., engineering, physics, physical sciences, space operations).
- **PME** includes all forms of available Air Force and joint PME.
- **Work experience** falls into five main categories:
 1. *Operational experience* in the tactical application of space and missile systems, including satellite C², spacelift, surveillance, warning, and missiles
 2. *Specific experience* reflected in specialty prefixes, including B for operations officer, C for commander, K for instructor, Q for standardization and evaluation examiner, R for contingency and war planner, S for safety officer, and W for weapons and tactics instructor
 3. *Functional experience*, including communications, intelligence, logistics, current operations, plans and programs, requirements, acquisition, research and development (R&D), test and evaluation (T&E), and others
 4. *Organizational experience*, such as at the group, wing, or numbered air force level or in the combat portion of the Force (Air Combat Command [ACC]; U.S. Air Forces in Europe; U.S. Air Forces, Pacific Command; Air Force Special Operations Command) level, or at such organizations as the AFSPC, the Air Staff, the National Reconnaissance Office (NRO), the Space and Missile Center (SMC), the U.S. Strategic Command (USSTRATCOM), the U.S. Space Command (USSPACECOM), the Space Warfare Center (SWC), and the Air Force Operational Test and Evaluation Center (AFOTEC)
 5. *Command experience*, including squadron, group, or wing command experience.

Focusing on the types of education, training, and job experience needed for space and missile jobs assumes that such assignments, events, or duties imbue or enhance the knowledge and skills—i.e., the competencies—needed to perform the actual missions, tasks, and functions associated with the jobs effectively. For instance, a tour in satellite C² is assumed to provide proficiency in the procedures and operations associated with, say, Global Positioning System satellites, while an assignment in a missile combat crew provides technical expertise and ability associated with an intercontinental ballistic missile system. Similarly, experience in plans and programs is assumed to provide Planning, Programming, and Budgeting System and other know-how pertinent to this specific function. Of course, having the opportunity to acquire the knowledge, skills, and abilities required for performing space and missile jobs cannot guarantee that an officer actually acquires them. Qualitative judgments always must be made about individual officers' competencies.

Experts Identified the Jobs' Requirements

To collect the data on the set of backgrounds needed for each job, the AFSPC Directorate of Training (DOT) designated senior 13S officers in each organization with authorized 13S AFSC positions (Table 2.1) who were either familiar with the functions of these positions and/or had experienced filling the positions.² To minimize the burden, we limited each rater to about 50 positions. They used (1) a systematic data sheet to consider and rate the importance of backgrounds for each job or group of jobs and (2) a list of the positions to be rated, containing information about each position's organizational affiliation, organizational name, location, organizational structure code,

² Richman and Quiñones (1996) suggest that raters are significantly more accurate in rating task importance when they have previously performed the job than if they have merely observed it. Since most of our raters were O-6 officers, they often were performing or had performed the jobs (or jobs similar to theirs) that they were rating at the O-6 and in previous jobs O-5 levels, but fewer would have performed the greater variety of jobs at the O-4 level.

Table 2.1
13S AFSC O-4, O-5, and O-6 Positions, by Organization
(number)

Organization	Positions
Headquarters Air Force Space Command	203
Headquarters 14th Air Force	20
21st Space Wing	63
30th Space Wing	28
45th Space Wing	27
50th Space Wing	55
Headquarters 20th Air Force	22
90th Space Wing	30
91st Space Wing	24
341st Space Wing	30
Space Warfare Center (SWC)	37
Space and Missile Center (SMC)	20
National Reconnaissance Office (NRO)	55
U.S. Space Command (USSPACECOM)	57
U.S. Strategic Command (USSTRATCOM)	67
Headquarters U.S. Air Force	57
Air Force Operational Test and Evaluation Center (AFOTEC)	32
U.S. Air Forces in Europe (USAFE)	11
U.S. Air Forces, Pacific Command (USPACAF)	6
Air Force Special Operations Command (AFSOC)	3
Air National Guard (ANG)	16
Air Combat Command (ACC)	48
Air Mobility Command (AMC)	3
Air Education and Training Command (AETC)	32
Air Intelligence Agency (AIA)	26
Miscellaneous Air Force agencies	19
Defense Threat Reduction Agency (DTRA)	42
Office of the Joint Chiefs of Staff (OJCS) and/or Office of the Secretary of Defense (OSD)	29
Miscellaneous joint organizations	30
Total	1,092^a

SOURCE: Air Force FY 2001 authorizations file.

NOTE: All data as of FY 2001.

^aIncludes 1,056 13S positions and 36 associated 10C, 87G, 88P, 91W, and 97E duty AFSC positions.

functional account code, and the position's name, any AFSC prefix, AFSC, authorized grade, and number.³

We asked the designated experts to rate each background as either critical, important, useful, or "not needed." We provided the following definitions:

- **Critical:** Experience, training, or education that is *absolutely essential* to effective performance of the job. Without this background, the officer cannot perform the job.
- **Important:** Experience, training, or education that is *helpful but not essential* to effective performance of the job. Without this background, the officer can still perform the job, although it is much more difficult and time-consuming.
- **Useful:** Experience, training, or education that is *good but not necessary* to perform the job. Without this background, the officer can perform the job with occasional difficulty.

We also asked raters to indicate the minimum duration of the experience and how recently it should have been acquired. The backgrounds were to be needed "as of today and within the next 5 years," rather than some time in the future, say 10 or 20 years from now.

Our plan was to have the designated officers use the form to rate their respective 50 or so positions over one or two days in a location away from their day-to-day duties. To increase the ratings' reliability and the credibility, each position was to be rated separately by two officers, with the expectation that they would reach consensus on differences through subsequent discussions. A RAND Corporation staff member was to be present to assist, guide, and monitor this process. We pilot-tested this approach with two groups of two senior officers and found that discussions among them were important for determining the specific backgrounds needed to perform the duties of the jobs they were rating. Although it took up to 20 minutes to identify the backgrounds needed for each of the first few positions, the time eventually shortened to a manageable 5 to 10 minutes per position.

³ Copies of the rating form and accompanying instructions are included in Appendix B. For an illustration, also see Appendix B for the list of 13S positions authorized in SMC.

For various reasons, however, implementing the above approach on a large scale turned out to be infeasible for many positions.⁴ Eventually, our approach to data collection had to adjust to the time limitations and preferences of the designated experts. Instead, we introduced the data-collection instrument through face-to-face meetings or teleconferences. Most respondents completed the form during the meeting, and a few completed and sent the forms later. In the end, 506 positions were rated in face-to-face meetings with individual experts and 166 positions were rated via mail surveys after brief reviews of the rating procedures during telephone conferences.⁵ We collected ratings from more than one expert for only 175 positions. Since we were unable to have the remaining 420 positions rated by the designated experts in a timely manner, we asked the assignment staff at AFPC to rate them, for completeness. Although this staff is less senior, assignment officers could rely on staff requisitions that describe the backgrounds desired in candidates for vacant positions. The AFPC staff could rate 370 of the remaining positions.⁶

Reliability of the Experts' Ratings of Required Backgrounds

To assess the reliability of the experts' ratings, we compared (1) the background ratings for the 175 positions that were rated independently by two raters and (2) the frequency of backgrounds rated important or critical in positions rated by the designated experts and

⁴ About when we began this study, AFSPC/DOT was given the responsibility to develop a professional management plan for Air Force space professionals, in response to Rumsfeld Space Commission (2001). Developing this plan demanded the full attention of the AFSPC/DOT staff and required many meetings involving many of the same senior officers designated to assist in providing the data for our study. This left little additional time to support our research. Moreover, some of the designated officers indicated that they were unable to rate some positions in their organizations.

⁵ A total of 65 officers (85 percent colonels and 15 percent lieutenant colonels) rated these positions from September 2001 to May 2002. These experts' backgrounds were generally similar to those of other 13S core officers in 2001, with only a couple of exceptions. Our raters were somewhat more likely to have space experience and less likely to have missile experience, and they were more likely to have experience at HQ AFSPC than other O-6s.

⁶ The 50 positions that were not rated have been excluded from the remaining analyses in Chapters Two and Four. However, they have been included in the optimization model, although without a corresponding set of needed backgrounds.

those rated by the AFPC assignment staff. In addition, we asked a group of eight senior officers (O-6s) not involved in the initial ratings to review the ratings for all positions and make appropriate adjustments.

Raters’ Reliability. The reliability of ratings between independent raters was generally high. For the 175 positions that were rated independently by two officers, the officers agreed on two-thirds of some 10,000 items rated and were within one rating (for instance, one officer rated an item critical and the other rated it important) in an additional 24 percent of the items (see Table 2.2).⁷

To assess whether some items were more vulnerable than others to differential ratings between the two raters, we also compared for each item the frequency with which the two raters were in agreement or agreed within one rating. For most items, the two raters agreed for

Table 2.2
Jobs Rated Critical, Important, Useful, or Not Needed, by Rater (percent)

Rater 1	Rater 2				Total
	Not Needed	Useful	Important	Critical	
Not needed	52	9	4	2	67
Useful	9	7	2	1	19
Important	3	2	3	2	10
Critical	1	0	1	1	3
Total	66	19	9	6	100

SOURCE: RAND survey of Air Force senior 135 core officers.
NOTE: Table entries indicate the percentages of cases in which raters’ ratings overlapped or failed to overlap. Shaded areas indicate when raters were within one scale point of each other.

⁷ Each of the 175 positions was rated for a total of 62 items. We collapsed ratings for five pairs of items because of their similarity of experience, including Air Staff or JCS and/or OSD, NRO or SMC, group or wing level, k or q prefix, and c or b prefix. Hence, this comparison was performed on 57 items for each of 175 positions for a total of 9,975 pairs of ratings.

85 percent or more of the 175 positions. “Any space operations,” squadron command, AFSPC experience, and grade were the four items for which the two raters agreed less often. But even for these items, the raters agreed for 70 percent or more of the positions (see Appendix B).

Ratings of Assignment Officers Versus Senior Officers. Generally, AFPC assignment staff—all captains about to be promoted to major—were about half as likely to rate an item as critical or important for performing O-4 or O-5 jobs. Assignment staff rated an average of four items per position as critical or important, compared to an average of seven items per position for senior officers. For O-6 jobs, however, there was no difference in the average number of items rated critical or important between assignment officers and senior officers. The observed differential may be due in part to the assignment officers’ lack of experience and, hence, knowledge about the positions they rated (all major or above positions) and the generally few requirements listed on the staff requisition forms that they used heavily.

Independent Review for Consistency. Finally, and as originally planned, we asked a group of eight senior O-6s to review the ratings of their colleagues. This review took place over two days in November 2002, with the eight officers divided into three groups: Three reviewed primarily space positions, three reviewed primarily missile positions, and two reviewed positions located primarily at NRO, SMC and other centers, and at ACC, the Air Intelligence Agency, and the Defense Threat Reduction Agency (DTRA). Within each group, the officers examined the original ratings and made adjustments by upgrading or downgrading ratings. Each group’s members discussed disagreements about specific ratings until they reached consensus.⁸

This review did not significantly change the original ratings for operational, organizational, or command backgrounds, but it slightly lowered the frequency with which some special (prefix) and func-

⁸ RAND staff’s role in this session was limited to ensuring that the initial ratings for all positions were reviewed and to answering questions that reviewers had on the rating rules.

tional experience was deemed critical or important. Reviewers lowered the demand ratings most significantly for the “instructor” and “standardization and evaluation” special experience, the plans and programs and the T&E functional experience, and technical education (see Appendix B).

Because of the closeness of the original ratings to those of the independent review, we chose to err on the conservative side and to report the original set of ratings in the remainder of this report. The reader should be aware that this decision may slightly overstate the backgrounds required for 13S jobs, most particularly for jobs requiring technical education and functional experience in plans and programs or T&E.⁹

Assessment of the Rating Process and Limitations

As participant-observers in the process used to identify the backgrounds required to perform 13S jobs effectively, we made the following observations. First, it appeared difficult for many officers to step back and ask what set of background experience a position “ideally” needs. Raters sometimes related more to the person(s) who had held the position and tended to rate the background requirements at least in part in terms of these officers’ previous backgrounds. A related observation that will be supported in the next section is that the resulting ratings are dominated by the “operational” culture of the space and missile specialty. *Most officers saw the primary mission of the positions as operating and using space and missile systems for specific ends and saw them relying on civilian personnel and consultants for the needed technical expertise.* This view seemed to predominate even though the raters were generally aware of the Rumsfeld Space Commission (2001) recommendations that the force become more involved in the design and acquisition of space systems and, hence, should have more technical expertise.

⁹ As a result of this decision, the gaps identified for technical education and T&E in Chapter Four may be somewhat overstated, although not eliminated. As we show in Chapter Six, optimal rates can be found to meet these more conservative requirements.

Finally, it became clear that rating the backgrounds that positions require is time and staff intensive and generally cannot be carried out with the necessary care and rigor while attending to other day-to-day duties.

In interpreting the resulting backgrounds needed for 13S positions, which we discuss in the next section and use again in Chapters Four and Five, readers should keep in mind that they reflect job demands as currently seen by senior active officers under today's prevailing mission requirements. These demands are likely to change with potential future changes in mission requirements (as the Rumsfeld Space Commission has recommended implementing and others may), the division of labor between civilian and military personnel, or technological advances, for example. In Chapter Six, we illustrate the use of an optimization model designed to assist the Air Force in assessing the feasibility and the effects on force development of potential such changes in job requirements.

Readers should also keep in mind that different officers are likely to disagree somewhat in the backgrounds they may consider critical or important for specific positions. We recommend concentrating on the general patterns rather than on specific items. In particular, should the Air Force desire to use these data to help match officer backgrounds with job requirements, we recommend that the ratings be reviewed systematically once more by general officers in light of both present and perceived future mission requirements.

Backgrounds Required for 13S Jobs

Our findings about the backgrounds needed for 13S jobs are discussed in this section. The frequency with which each individual background is required is discussed first. We then show that 13S jobs at each grade can be combined into relatively few groups that require similar background combinations. Grouping jobs is important because it can facilitate the Air Force's proactive management of the 13S workforce. Finally, we address in greater detail the demand for

tactical operational experience and the demand for technical education.

Here we report only on the backgrounds that were rated as either critical or important to perform the job effectively. We do not consider backgrounds that were rated useful because raters had a tendency (but not consistently) to rate many requirements in any one area (such as functional or organizational) as useful. Upon inquiry, raters said their intent was to indicate that only one or two of the backgrounds so rated would actually be helpful to have.

Backgrounds Demanded

Table 2.3 shows the frequency with which each one of the backgrounds is needed for O-4, O-5, and O-6 13S jobs.¹⁰ Broad patterns support the general validity of the demand ratings. As expected, the demand for most backgrounds increases with grade. This is typically the pattern for specialty, functional, organizational, and command backgrounds.

The frequency of jobs requiring an officer in grade also increases with grade. Raters indicated that nearly one out of two O-4 jobs could be filled effectively with an officer below that grade but that less than one out of five O-6 jobs could be filled with such an officer.

Few individual backgrounds are demanded by more than one-half of the positions in a given grade, and this only for O-6 positions. These “big” backgrounds include current operations, HQ AFSPC, Air Staff, and command. At lower grades, frequently demanded backgrounds also include current operations, HQ AFSPC, and instructor (K prefix) or standardization and evaluation (Q prefix).

¹⁰ For analysis, we consolidated the 70 original job dimensions listed on the rating sheet into 56 categories. To do this, we deleted “combat rated” and “any rated” because few jobs required these backgrounds; management of civilian, contracting, and financial management and flight command because these elements could not be captured on the supply side; technical and PME training because the Air Force specialty prefix captures the first and because the second is a prerequisite for rank promotion; and AETC because the education and training element captures it. We also consolidated the following types of command experience into one category: operations, support, or logistics group command; numbered air force or joint command; and center or school command. Finally, education was divided between engineering and other technical education.

Table 2.3
13S Jobs Requiring Specified Backgrounds, by Grade (percent)

Background Required	Grade		
	O-4	O-5	O-6
Operations			
Satellite C ²	13	11	20
Spacelift	5	5	6
Surveillance	3	5	4
Warning	3	5	1
Surveillance and warning	5	5	6
Missile	25	17	20
Any space (no missile)	20	16	24
Any space or missile	18	26	20
Specialty Prefix			
C = Commander	1	10	67
B = Squadron operations officer	2	22	31
K = Instructor	31	29	36
Q = Standardization and evaluation examiner	30	29	34
R = Contingency and war planner	10	10	20
S = Safety officer	3	3	7
T = Formal training instructor	6	4	7
V = Automated functional applications analyst	1	1	0
W = Weapons and tactics instructor	13	6	6
X = Nonrated aircrew member	3	3	0
Y = Analytic studies officer	2	3	2
Functional			
Personnel	1	3	2
Intelligence	2	5	10
Current operations	29	36	70
Logistics	9	9	5
Plans and programs	18	24	43
Communications	5	7	7
Requirements	11	15	35
Research and development	5	10	17
Acquisition	10	19	29
Test and evaluation	17	17	23
Political-military	7	5	8
Education and training	2	5	8
Organization			
Group	21	19	39
Wing	20	21	41
14th Air Force	9	11	18
20th Air Force	11	8	8
Other numbered air force	6	2	3
Combat air force	9	11	8
AFSPC	20	42	64
AIA	5	3	1
DTRA	5	4	0
AFOTEC	3	3	2
NRO	10	15	20

Table 2.3—Continued

Background Required	Grade		
	O-4	O-5	O-6
SMC	5	10	20
SWC	3	6	9
Air Staff	15	25	52
OJSC or OSD	10	15	17
USSTRATCOM	9	9	6
USSPACECOM	11	22	17
Command			
Squadron	3	11	64
Group		1	36
Wing		1	7
Numbered air force or joint command		0	8
Center or other		1	6
Education			
Engineering	8	5	16
Other technical	4	5	5
In-grade required	55	64	83

SOURCE: RAND survey of senior 135 core Air Force officers.

The share of jobs requiring a specific type of tactical operational experience remains generally constant from O-4 to O-6, except that the demand for satellite C^2 experience nearly doubles for O-6 jobs. Similarly, the share of jobs requiring technical education doubles for O-6 jobs. We further examine the demand for these two backgrounds below.

Demand for Tactical Experience

Raters often indicated that jobs needed backgrounds in one or more types of specific operational experience (e.g., satellite C^2 and/or spacelift) or in one of the more-generic collections of experience: “any space” or “any missile or space.” After discussing this pattern with several raters, we interpreted such multiple, either-or ratings as “preferring” an officer with the specific experience indicated and that, were no such officer available, someone with the generic background would be acceptable. Table 2.4 shows that experience in a specific mission area is preferred for about half of the jobs. In contrast, a specific tactical experience is essential—that is, it is either critical

Table 2.4
135 Jobs Needing Each Type of Prior Tactical Experience, by Grade
(percent)

Prior Operational Experience	Preferred			Needed		
	O-4	O-5	O-6	O-4	O-5	O-6
Satellite C ²	13	11	20	4	3	3
Surveillance and/or warning	11	14	10	4	3	1
Spacelift	5	5	6	0	0	3
Missile	25	17	20	13	10	7
Subtotal	54	47	56	21	16	14
Any space	20	16	24	29	26	33
Either space or missile	18	26	20	42	46	53
Subtotal	38	42	44	71	72	86
Total	92	89	100	92	88	100

SOURCE: RAND survey of senior 135 core Air Force officers.

or important—for no more than 20 percent of O-4 jobs and 15 percent of O-5 and O-6 jobs. That is, for about 80 percent or more of the jobs at a grade, experience in any space mission or in missiles is acceptable, suggesting that the operational competencies critical or important to performing most O-4 to O-6 jobs can be acquired in multiple mission areas.

A background in missiles is the most frequently preferred—for about 20 percent of the jobs regardless of grade—but is needed for only about half as many. By contrast, none of the space mission areas except satellite C² is specifically preferred for more than 5 to 14 percent of jobs; satellite C² is preferred for 20 percent of O-6 jobs. Experience in a specific space mission is needed, however, in an extremely low share of the O-4 through O-6 jobs (4 percent or fewer), regardless of the authorized grade.

Demand for Technical Education

Table 2.5 indicates that respondents judged technical education necessary for about one out of every ten O-4 and O-5 positions and one out of every five O-6 positions. This relatively low share contrasts

Table 2.5
13S Jobs Requiring Technical Education, by Type (percent)

Technical Education Required	Grade		
	O-4	O-5	O-6
Engineering	8.0	5.4	16.1
Physical sciences	3.7	3.4	4.6
Space operations	0.3	0.6	0.0
Computer science, operation research, mathematics	0.3	0.6	0.0
Total	12.3	10.0	20.7

SOURCE: RAND survey of senior 13S core Air Force officers.

with the Rumsfeld Space Commission's conclusion that space and missile jobs generally require technical education to be performed effectively. However, it is consistent with the view widely held within the force that the primary mission of space and missile officers is the operational, tactical, and strategic use of space platforms and missiles, relying substantially on civilians for technical expertise.

Among the various types of technical education, education in engineering or physical sciences is needed most often. Few jobs require formal education in computer sciences, operations research, or mathematics—or, even more to the point, space operations.

The few jobs needing technical education are concentrated in just a few organizations, mostly SWC, HQ USSPACECOM (mainly in the requirements section), and in the Air Force element, Office of Space and Technology. NRO and SMC 13S jobs apparently do not typically require technical education, according to our raters.

Combinations of Backgrounds Needed for 13S Jobs

Beyond knowing how many jobs need each specific background, it is even more important to ascertain the *combinations* of backgrounds that specific 13S jobs need. We show below that the 13S jobs at each grade can be aggregated into groups that need similar background

combinations.¹¹ Not surprisingly, jobs at higher grades tend to need more backgrounds in combination.

Backgrounds Needed for O-4 Positions

Table 2.6 shows how many of the 650 rated O-4 jobs fall into each of eight groups. The largest group includes 359 jobs (55 percent) that need no background beyond operational experience in either a preferred or generic mission area. These jobs are distributed across a variety of organizations.

In addition to operational experience, three groups need one or more types of experience. The second-largest group, with 53 jobs (mostly squadron-level staff positions in the 14th and 20th Air Forces), needs experience as an instructor, and some positions also need experience in current operations. Distributed across the MAJCOMs are 32 positions that require experience as in weapons and tactics instruction (W prefix); some of these also require experience at the MAJCOM level. At the AFSPC Directorate of Requirements, 35 positions require technical education; a few of these positions also need experience at NRO or in another acquisition or SMC job.

The remaining 20 percent of the O-4 positions generally require two core backgrounds beyond operational experience. At the AFSPC Directorate of Plans and Programs (XP) and squadrons at 14th Air Force and at ACC, 34 positions require current operations and plans and programs backgrounds; the 14th Air Force and ACC positions also require a background in weapons and tactics (W prefix). Another 47 positions need experience in current operations and at the group

¹¹ We used statistical cluster analysis to identify the groups of 13S jobs shown in the following tables. This analytical technique groups individual jobs that require a similar background, starting with as many groups as there are jobs, and sequentially adds jobs to groups and combines groups until all jobs are grouped together. The groups shown here were created in one of the latest stages in this process. In interpreting these groupings, the reader should keep in mind that some jobs within a group may not need some of the backgrounds that characterize the group, and some may need background(s) in addition to those characterizing the group (Gore, 2000; Anderberg, 1973).

Table 2.6
135 O-4 Jobs Needing Specific Combinations of Backgrounds

Combination of Backgrounds	Jobs Needing Each	Organizational Locations of Jobs
Mission experience only, miscellaneous requirements (359)		
Satellite C ²	42	Squadrons in 50th Space Wing, AFOTEC, ACC
Spacelift	21	AFOTEC, AFSPC/DO
Surveillance/warning	51	USSPACECOM, 21th Operations Group (OG), OJCS
Missile	44	20th Air Force, AFOTEC, Air Force Safety Center, AIA, DTRA USSPACECOM, AFSPC, Air Staff, ACC, AIA, AETC, AFE, DTRA, Readiness Center
None	201	
Instructor/educator (53)		
Missile	35	Squadrons in 20th Air Force
Current operations, satellite C ²	5	Squadrons in 14th Air Force
None	13	Air Staff, OJCS, AETC
Weapons and tactics instructor (W prefix) (32)		
MAJCOM	21	ACC, AIA, AFSPC, AETC
None	11	ACC, PAF, AETC, Air Staff
Technical education (35)		
Acquisition, SMC, spacelift	6	AFSPC/DR
Acquisition, SMC, satellite C ²	5	AFSPC/DR
NRO, surveillance	6	AFSPC/DR
None	18	AFSPC/DR
Current operations, plans and programs (34)		
Weapons and tactics	8	ACC, AFE AFSPC/XP, AFSPC/XO, squadrons in 14th Air Force
Satellite C ²	16	
None	10	AFSPC/XP
Current operations, group or wing (97)		
Instructor, flight commander (CC), missile	19	USSTRATCOM, AFSPC/DO
Instructor, flight CC	38	USSPACECOM, AFSPC/DO, squadrons or groups in 14th Air Force
Contingency and war planner or nonrated aircrew, numbered air force, missile	40	USSTRATCOM

Table 2.6—Continued

Combination of Backgrounds	Jobs Needing Each	Organizational Locations of Jobs
Current operations, group or wing, technical education, MAJCOM (20)		
Higher HQ	9	SWC
Safety, test and evaluation, missiles	5	576 flight test squadron (test and evaluation)
Requirement, test and evaluation, surveillance and warning	6	017 flight test squadron(test and evaluation)
Current operations, plans and programs, flight CC, MAJCOM, higher HQ (20)		
NRO, technical education	5	AF/XO, AF/XP
Unified command	15	AF/X, AF/DO, ACC

SOURCE: RAND survey of senior 135 core Air Force officers.

NOTE: Numbers in parentheses indicate the number of jobs in the group.

or wing level. Within this group, 40 positions in USSTRATCOM also need experience either as a contingency and war planner (R prefix) or as a nonrated aircrew member (X prefix), and 57 positions in the AFSCP Directorate of Operations (DO) and in squadrons and groups in 14th Air Force and USSTRATCOM need both instructor and flight commander experience. In addition to current operations and group or wing backgrounds, another 20 positions need MAJCOM experience and a technical education. Nine of the positions at SWC also require higher-headquarters background, and 11 positions at two T&E flight squadrons also require experience in T&E and in safety or requirements.¹²

Finally, the last 20 positions, mostly at the Air Staff, require multiple backgrounds, in current operations, plans and programs, and flight command and at a MAJCOM or a higher headquarters (Air Staff, OJCS, OSD), with five of these positions also requiring NRO experience and another 15 requiring unified command experi-

¹² A higher-headquarters background includes experience at HQ Air Force, the Office of the Joint Chiefs of Staff (OJCS), the Office of the Secretary of Defense (OSD), or a unified command.

ence. It is unlikely that 13S officers could acquire this variety of experience by the time they are majors. But because both the original raters and the reviewers generally agreed on the backgrounds needed for these positions, perhaps they should be authorized at a higher grade.

Backgrounds Needed for O-5 Jobs

Nearly half (45 percent) of O-5 positions require no more than operational experience in a preferred or generic mission area (Table 2.7). These positions are also distributed across AFSPC units, other MAJCOMs, and USSPACECOM.

The remaining positions combine into five groups. Two groups require only one background beyond operations. One group of 12 positions at the Air Staff (space technology, architecture) requires NRO experience. And another group of 54 positions, some at the Air Staff and some at AFOTEC, requires MAJCOM-level experience.

The other three groups, accounting for about one third of all O-5 positions, need different combinations of types of experience. One group of 44 needs instructor, current operations, and MAJCOM-level backgrounds, with some positions at 14th Air Force and AFSPC/XP also needing experience as a contingency and war planner (R prefix); others at SWC needing a technical education; and still others at AFSPC, OSD, and OJCS needing a background at a higher headquarters.

Another 75 positions need experience in current operations, at the group or wing level, as a flight commander and experience at the MAJCOM level. Within this group are five subsets needing one or two different additional backgrounds. At the Air Staff, 27 XP and XO jobs require plans and programs and higher-headquarters staff; 11 positions at USSPACECOM and the 50th Operations Group require experience in requirements and acquisition; eight squadron command positions in 14th Air Force require experience as an operations officer; 17 positions at 14th Air Force, 20th Air Force, AFSPC/DO, and other numbered air forces require squadron command experience; and 12 positions at USSTRATCOM require experience either as a contingency and war planner or as nonrated aircrew.

Table 2.7
13S O-5 Jobs Needing Different Combinations of Backgrounds

Combination of Backgrounds	Jobs Needing Each	Organizational Locations of Jobs
Mission experience only, miscellaneous requirements (254)		
Missile	36	Groups in 20th Air Force, AF/DO, Unified command
Surveillance and warning	18	USSPACECOM, OJCS
None	100	Readiness Center, AFOTEC, AFSPC
NRO (12)		
None	12	Air Staff (space technology, architecture)
MAJCOM (54)		
Satellite C ²	16	Wing or squadron staff in 14th Air Force, Air Staff
Surveillance/warning	28	Operations officers in 14th Air Force, OJCS
None	10	AFOTEC
Instructor, current operations, MAJCOM (44)		
Technical education	11	SWC
Higher HQ	24	AFSPC, OSD, OJCS, SQ/CCs in 14th Air Force
Contingency and war planner	9	14th Air Force, AFSPC/XP
Current operations, flight CC, Group or wing, MAJCOM (75)		
Plans and programs, higher HQ, Unified command	27	AF/XP, AF/XO
Acquisition, requirements	11	USSPACECOM, 50SW, 50OG
Operations officer	8	SQ/CCs in 14th Air Force
Squadron commander	17	AFSPC/DO, 20th Air Force OG/CC, 45th Space Wing, 50th OG/CC
Contingency and war planner or nonrated aircrew, numbered air force	12	USSTRATCOM
Current operations, acquisition, requirements, SQ/CC, SMC or NRO, higher HQ (16)		
Technical education	16	AFSPC/DR, AFOTEC

SOURCE: RAND survey of senior 13S core Air Force officers.

NOTE: Numbers in parentheses indicate the number of jobs in the group.

The last group of 16 positions also needs a combination of backgrounds, including technical education; experience in acquisition, requirements, and squadron command; experience at the group

or wing level, SMC, or NRO; and experience as higher-headquarters staff. These positions are located at AFSPC's Directorate of Operations; the Air Force Deputy Chief of Staff for Plans and Programs; the Air Force Deputy Chief of Staff for Air and Space Operations, and AFOTEC.

Backgrounds Needed for O-6 Jobs

The 87 O-6 positions that were rated all require multiple backgrounds and fall into six main groups (Table 2.8).¹³ The first group consists of six positions at USSPACECOM that need a combination of contingency and war planner and satellite C² backgrounds.

Another group, consisting of 18 positions, requires experience in missile and squadron command. Six of the positions at AFSPC and the Air Staff need experience as an instructor and in current operations; three at DTRA need instructor, T&E, and unified command experience; and nine missile wing and operations group command positions require group command experience.

Five SWC positions require experience in squadron command; at a numbered air force, MAJCOM, higher headquarters, or a unified command; and a technical education.

Another group, consisting of 26 positions, requires four core types of experience: current operations, squadron command, MAJCOM, and/or higher headquarters. In addition, four of these positions at the 50th Space Wing and AFSPC/DO need a group command background; eight positions at AFSPC need a background at group or wing level; and nine positions at 21st Space Wing, the 21st Operations Group, and 14th Air Force require experience as an instructor and at group or wing level.

¹³ Note, however, that 13S core officers (at O-6 and other grades) hold some jobs that do not require specific 13S experience. Nearly half the colonels in the 13S core filled such jobs in FY 2001. Our data-collection effort to date has not identified the backgrounds needed for those jobs.

Table 2.8
135 O-6 Jobs Needing Different Combinations of Backgrounds

Combination of Backgrounds	Jobs Needing Each	Organizational Locations of Jobs
Contingency and war planner, satellite C ² (6)		
Miscellaneous	6	USSPACECOM
SQ/CC, missile (18)		
Instructor, current operations	6	AFSPC, 45SW, Air Staff
Instructor, test and evaluation, unified command	3	DTRA
Group/CC	9	Missile wing/CCs, OG/CCs
SQ/CC, numbered air force, MAJCOM, higher HQ, unified command, technical education (5)	5	SWC
Current operations, SQ/CC, MAJCOM and/or higher HQ (26)		
Instructor, group or wing	9	21SW/CC, 21OG/CC, 14AF
Group or wing	8	AFSPC command (FAC1010)
Spacelift	5	30SW/CC, 30OG/CC, AFSPC/DO
Group/CC, satellite C ²	4	50SW/CC, AFSPC/DO
Current operations, plans and pro- grams, SQ/CC, higher HQ (10)		
NRO	2	OJCS
None	8	AFSPC/CV, Readiness Center
Current operations, acquisition, requirement, SQ/CC, SMC, or NRO, MAJCOM and/or higher HQ (22)		
Technical education	9	AFSPC/DR, space technology office
Test and evaluation	7	Air Staff, centers
WG/CC, satellite C ²	2	50SW, NRO
GR/CC	4	AFSPC/DO, 45SW, Battlelab

SOURCE: RAND survey of senior 135 core Air Force officers.

NOTE: Numbers in parentheses indicate the number of jobs in the group.

Ten positions need experience in current operations, plans and programs, squadron command, and higher headquarters. Eight of these positions are at AFSPC/XP and the Air Force Readiness Center; the other two, located at OJCS, also need experience at NRO.

The last group of 22 positions needs a combination of current operations, acquisition, requirements, NRO or SMC, and MAJCOM or higher-headquarters backgrounds. Within this group, four subsets need a different background. Nine positions at AFSPC/DR and the

Space and Technology Office require a technical education. Seven jobs at the Air Staff and various centers require plans and programs experience; just two positions at the 50th Space Wing and NRO require wing command experience; and four positions at AFSPC/DO, 45th Space Wing, and the battlelab require group command experience.

Conclusions

We have demonstrated that it is possible to systematically identify the education, training, and job experience that 13S officer jobs require. We will use this information in Chapter Four to assess the adequacy of the preparation and career paths of space officers and in Chapter Six to analyze and design successive job assignments for officers that meet job requirements more fully. In addition, the Air Force can use this information to match individual officers to individual job requirements and to manage job assignments proactively over a career. The latter is all the more feasible because the large number of 13S officer jobs can be aggregated into a relatively small number of groupings of jobs that need a similar combination of backgrounds. Finally, if this information is appropriately standardized and refined, individual officers can use it to make career decisions and plan their own development in congruence with overall space and missile requirements.

The backgrounds described in this section as being needed for 13S O-4, O-5, and O-6 jobs appear to reflect today's emphasis on the *operational* use of space and missile assets, with primary reliance on civilians and contractors for in-depth technical expertise. Only one in every ten O-4 and O-5 jobs and one in every five O-6 jobs is regarded as needing an officer with a technical academic education. In contrast, virtually all 13S jobs need some form of tactical operational experience. For about four out of five jobs, senior 13S core officers considered operational experience in either satellite C², spacelift, surveillance, warning, or missiles to be acceptable, leaving great flexibility for assigning officers to jobs. Nevertheless, a specific

operational background is preferred for about 40 percent of 13S jobs. Experience in missiles is most frequently preferred, for about 20 percent of O-4 to O-6 jobs. The second most-preferred operational experience is satellite C², for about 12 percent of O-4 and O-5 jobs and 20 percent of O-6 jobs.

Some form of tactical operational experience is all that is needed for about half of the 13S O-4 and O-5 jobs. Beyond operational experience, the remaining jobs also need one or several more special, functional, organizational, and/or command experience. These jobs aggregate into a limited number of groups needing similar background combinations (see Tables 2.6 to 2.8). About 33 percent of O-4 jobs and 20 percent of O-5 jobs combine into groups that need only one or two additional backgrounds, with technical education, instructor, contingency and war planner, current operations, and/or MAJCOM-level experience among the most frequently needed. The remaining O-4 and O-5 jobs need four or more backgrounds in different combinations.

As expected, all O-6 jobs need four or more backgrounds, with nearly all needing experience in current operations, squadron command, MAJCOM, and higher-headquarters staff and with a small set of jobs at all three grades needing experience in acquisition, requirements, T&E, NRO or SMC, and higher headquarters, usually along with a technical education.

Space and Missile Officers' Backgrounds and Career Paths: Supply

This chapter describes the education, training, and experience space and missile core officers garner at various stages in their careers. We first discuss development of the data for this analysis, then the range of backgrounds that space and missile officers had accumulated as of 2001; the trends in the backgrounds accumulated; and, finally, the range of career paths that space and missile officers apparently follow.

Identifying Officers' Backgrounds

The AFPC Historical Data File

We used historical records from AFPC to identify the education, training, and experience that space and missile officers had acquired as of the end of each fiscal year from 1975 to 2001. Each officer's yearly record shows his or her current grade, academic degrees, PME, Air Force Institute of Technology attendance, core AFSC, and position held.¹ The record also contains the date the officer entered active-duty service and the date of separation, if applicable.

Translating Positions Held to Backgrounds Acquired

For this study, we first extracted (from the records of all Air Force officers on record since 1975) the yearly records of officers who had *a*

¹ The positions are characterized by duty AFSC, specialty code, command level, organization type and kind, unit, organizational structure name, location, rated position identifier (if any), and functional category.

minimum of one tour in a 13S-duty AFSC at any time since 1975, regardless of their core AFSC. More than 7,000 officers met this criterion. Of these, 3,436 were core 13S space and missile officers still on active duty in 2001.

Second, we translated the information on the multiple positions officers had held into the same terms we discussed in Chapter Two for describing the jobs' demands—i.e., to describe the operational, special, functional, organizational, and command experience the officers had gained. For each job held, we credited each officer with the appropriate experience according to the following rules:

- **Academics** credit was awarded according to academic codes.
- **PME** credit was awarded according to training codes.
- **Work experience** fell into five main categories:
 1. *Operational experience* (missile, satellite C², spacelift, surveillance and/or warning) was awarded according to the appropriate operational AFSCs and/or assignments to operational space or missile units at the wing level or below, including Cheyenne Mountain Air Force Base operations centers (i.e., missile warning and space control centers). AFSCs included historical commanders and operations officers (1896/2096s and 1816/2016 and 003/006/008).
 2. *Specific experience* was awarded according to prefixes received.
 3. *Functional experience* was awarded according to assigned functional duty (e.g., J-3, Directorate of Operations) in group-level and above organizations, functional AFSCs, functional codes, and major functional organizations (e.g., Air Intelligence Agency [AIA], AETC).
 4. *Command experience* was awarded according to C-prefix and group or wing AFSCs (e.g., 10C, 91W).
 5. *Organizational experience* was awarded according to organizational and command codes.

A senior Air Force officer, in consultation with other Air Force officers, identified the backgrounds that can be acquired from each type of 13S and other jobs, in a way similar to the process followed on the demand side. Based on this identification, a heuristic set of

rules was written for computerized awarding of experience each officer acquires at each job he or she has held throughout his or her career.

An Illustrative Career History

Table 3.1 illustrates the outcome of this process for one officer, a now-retired colonel. The key AFPC descriptors of each position this officer held during his career are shown in the matrix on the left-hand side of the table. The corresponding "translated" backgrounds types that he had gained are shown on the right-hand side of the table. The available history of this officer starts in his third year of service as a second lieutenant. After holding a missile maintenance position, he shifted to missile crew duty, then spent several years at AETC acquiring education and training experience. Then came three years in a tactical missile squadron, during which he spent one year as operations officer and one year as squadron commander. This was followed by a year on the AFSPC/DO staff, and then five more years of command, three of them as a spacelift squadron commander and two as an operations group commander in satellite C². Finally, two of this officer's last four years were spent as an Inspector General officer at AFSPC and two as vice commander of the 20th Air Force.

This process of crediting the appropriate background to each officer was repeated using the algorithm sketched above for each job held by each officer. This information was stored in a longitudinal data file and is now a resource available to the Air Force.

Limitations

Despite the care taken in determining the appropriate officer backgrounds with the assistance of a knowledgeable 13S Air Force officer, the career histories we generated have several notable limitations. First, the original AFPC data list only the jobs held at the end of each fiscal year. Hence, officers holding two jobs during the year may not be credited with the experience gained in the first job (unless that was his or her job at the end of the previous year). This probably is not a

Table 3.1
Experience a 13S Colonel Acquires Over the Course of His or Her Career

Year	dpfx	dafsc	grade	ppfx	pafsc	cafsc	cmd	org	orgsrr	fac	inst	Operational experience										Prefix	Functional experience						Command experience			Org experience																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
												Satellite C2	Space/air	Missiles	Other	Any 13S	Any space	C = Commander	B = Ops other	Other	Current ops	Logistics	Plan/prog	Acquisition	Educ/training	Other	Flight	Squadron	Ops group	Any group	Wing	MAF	Other	Group	Wing	144F	204F	CAF	AF3PC	AETC	Air staff	AMC	Other																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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SOURCE: AFPC historical personnel data.

NOTE: This figure is illustrative and shows only a subset of the backgrounds actually used in the study.

major limitation because officers hold most jobs for a year or more. Moreover, the experience gained in a job held for less than a year is unlikely to be as valuable as that gained over a longer period.

A more important limitation is due to the many organizational and coding changes that have taken place since 1975. We spent considerable time reconstituting the organizational and coding history of space and missile units and functions, but we cannot be certain that we recognized all relevant positions. Positions in NRO were particularly difficult to identify, especially those from the 1970s and 1980s. Also, organization codes are missing for 1980 and 1981, and we had to ascertain equivalencies between some earlier and later organizations. In the end, some judgment was involved in associating specific experience with certain positions.

Incumbents' Backgrounds

There were 3,436 space and missile (13S) core officers on active duty in 2001: 272 first lieutenants; 457 second lieutenants; 1,342 captains; 787 majors; 421 lieutenant colonels; and 156 colonels. We begin by describing the distribution of education, training, and experience for the force as a whole and then the technical education and tactical operational experience available in the force as a whole. Concerns have been raised that too few space and missile officers have technical academic degrees and that the depth of operational experience is inadequate.

Availability of Specific Backgrounds

Table 3.2 shows the share of O-4, O-5, and O-6 officers with each of the various backgrounds. As expected, the share of officers with a specific background typically increases with grade. This pattern holds for nearly all special, functional, organizational, PME, and command experience. Notable exceptions, however, are tactical operational experience and technical education. As discussed in greater detail later in this section, differences in academic preparation and in the acquisi-

Table 3.2
135 Core Officers with Specified Backgrounds, by Grade (percent)

Background Acquired	Grade				
	O-2	O-3	O-4	O-5	O-6
Operations					
Satellite C ²	13	29	44	30	20
Spacelift	7	13	18	20	21
Surveillance	2	10	13	10	13
Warning	1	5	9	5	5
Surveillance and warning	5	12	20	31	40
Missile	77	90	70	71	80
AFS prefix					
C = Commander	—	2	5	40	81
B = Squadron operations officer	—	—	10	38	31
K = Instructor	20	59	53	48	48
Q = Standardization and evaluation examiner	9	25	40	41	34
R = Contingency and war planner	—	2	7	9	8
S = Safety officer	—	0.5	1	3	2
T = Formal training instructor	1	17	25	23	16
V = Automated functional applications analyst	—	1	3	5	11
W = Weapons and tactics instructor	—	3	6	2	—
X = Nonrated aircrew member	—	—	4	12	13
Y = Analytic studies officer	—	—	1	2	6
Functional					
Personnel	—	3	6	10	10
Intelligence	—	3	8	7	10
Current operations	9	40	85	96	97
Logistics	—	10	35	35	35
Plans and programs	—	4	28	51	71
Communications	—	6	11	12	9
Requirements	—	8	23	24	22
Research and development	—	5	10	9	8
Acquisition	—	8	16	18	24
Test and evaluation	—	7	16	17	10
Political-military	—	—	5	16	24
Education and training ^a	—	—	53	62	58
Organization					
Group	9	26	33	33	65
Wing	—	9	52	74	81
14th Air Force	—	2	6	5	4
20th Air Force	—	2	6	10	6
Other numbered air force	—	1	1	6	3
CAF	—	11	26	29	26

Table 3.2—Continued

Background Acquired	Grade				
	O-2	O-3	O-4	O-5	O-6
AFSPC	—	4	33	40	45
AIA	—	3	5	4	7
DTRA	—	1	3	5	4
AFOTEC	—	2	4	4	2
NRO	—	3	8	5	12
SMC	—	3	8	10	16
SWC	—	2	7	2	3
Air Staff	—	—	11	29	45
OJCS/OSD	—	—	5	18	38
USSTRATCOM	—	2	12	22	11
USSPACECOM	—	4	14	20	21
Command					
Squadron	—	—	—	42	79
Operations group	—	—	—	3	28
Any group	—	—	—	5	47
Wing	—	—	—	—	13
Numbered air force or joint command	—	—	—	5	9
Center or other	—	—	1	3	4
Education					
Engineering	21	21	26	12	6
Other Technical	18	23	29	30	27
Professional Military Education					
Squadron Officer School	—	73	100	99	91
Intermediate Service School	—	—	10	100	100
Senior Service School	—	—	—	63	100
Air Warfare School	—	—	1	2	6
Joint Command Officer School	—	—	1	24	24

SOURCE: AFPC historical personnel data.

NOTES: A dash means that no officer of the specified grade acquired the specified background. All data as of FY 2001.

^aA recent change in coding does not allow equivalent computation at grades O-2 and O-3.

tion of operational experience across cohorts of officers over time explain this differential pattern.

Several backgrounds were acquired by half or more of space and missile officers relatively early in their careers, by grade O-4. These include missile operational experience, instructor (K prefix), current operations, wing experience, and Squadron Officer School PME. By

grade O-5, more than half of 13S officers had also acquired experience in plans and programs. And at grade O-6, most officers (80 percent) had command experience. Officers with no command background had careers mostly at NRO and SMC or at the Pentagon in OJCS and OSD.

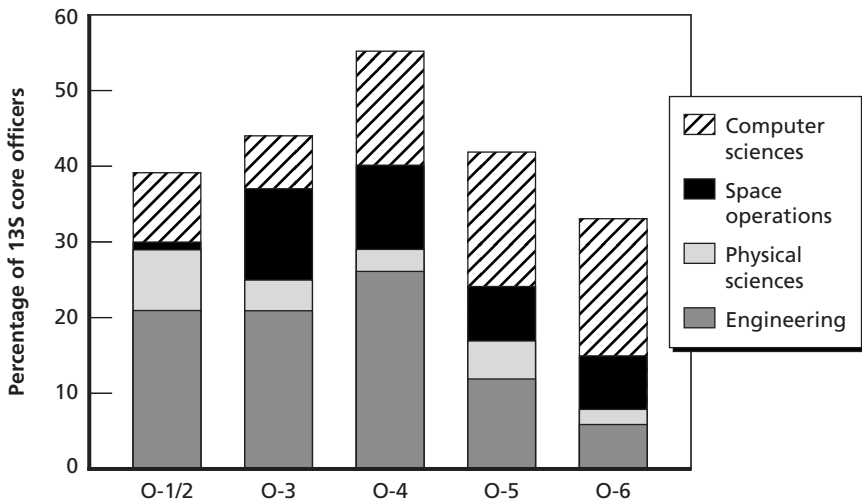
One out of four O-6 officers had acquired experience in acquisition or R&D, mainly through tours at NRO or SMC. Rumsfeld Space Commission (2001, p. xvi) raised the question of whether this is enough to provide the leadership skills necessary for effectively guiding further development and use of space systems.

Technical Education

In the early days of the development of space assets, the same group of officers developed, acquired, launched, and operated satellites—i.e., the cradle-to-grave approach. As the systems matured and became more numerous, a division of labor evolved, eventually separating the development and acquisition of space systems from their operations. Operations then began to rely more on good training and the use of uniform operating procedures, limiting the need for technical education and an engineering background (Rumsfeld Space Commission, 2001, p. 11). Today's only requirement for entry into the 13S career field is a bachelor's degree of any kind.

Despite this trend, the space and missile specialty continues to attract a significant share of officers trained as engineers or in other technical fields (see Figure 3.1). In 2001, about one out of five 13S core officers was an engineer, and one out of two had a technical academic background. The share of officers with a technical background was highest in the early grades, peaking at O-4, at which 26 percent had an engineering degree and 55 percent had some type of technical background. Fewer officers at the higher grades had technical educations, however, with 6 percent of O-6s having an engineering background and 33 percent a technical background, for example.

The lower share of officers with technical education as grade increases suggests the possibility that the retention rate for officers with such a background is lower. Indeed, a prevailing perception that

Figure 3.1**Percentage of 13S Core Officers by Type of Technical Education, 2001**

SOURCE: AFPC historical personnel data.

RAND MG382-3.1

opportunities in the private sector for such officers abound may be the reason for the pattern shown in Figure 3.1. That perception is errant, however. Retention rates for officers with technical backgrounds have been slightly higher than in the 13S cohorts that entered in 1975 and in 1980 and have mirrored the retention for others in cohorts that entered in 1985 and 1990 (see Appendix C).

The real reason that the share of officers with technical backgrounds was lower among senior officers is simply that the share of officers with such backgrounds was lower for earlier cohorts of officers. In the earlier cohorts of officers, those entering the force in 1975 and 1980 (the O-6s and O-5s of today), fewer than 30 percent had technical educations, but for cohorts entering since the mid-1980s (the O-3s and O-4s of today), the share has held relatively steady at about 50 percent (see Appendix C).

In brief, a continuing, large share of officers entering the 13S force, about one of every two, has brought a technical background, even though the need for such education has, arguably, diminished

over time because of the separation of developmental and acquisition functions from operational functions.

Tactical Operational Experience

As the number and complexity of space systems increased over the years, so did the share of missile and space officers who gained operational experience in space systems. In the 1970s through the mid-1980s, young officers joining the Air Force had few opportunities to gain operational experience in space missions, and these opportunities were primarily in surveillance and warning. In the second half of the 1980s, opportunities for gaining experience in these systems expanded rapidly, and satellite C² operation was established as a shred within AFSC.

Consequently, today's senior 13S core officers (O-5s and O-6s), who joined the Air Force prior to about 1985, are much less likely than midcareer and younger officers to have gained space operational experience early in their careers. As these earlier officers assumed command leadership positions during the 1990s in a functionally expanded space and missile force, many commanded space squadrons or wings without having acquired crew experience in the systems they were overseeing. Indeed, more than one-half of O-6 core 13S officers with space experience acquired this experience as commanders rather than as crewmembers (Table 3.3). Similarly, from one-fourth to one-third of O-5 core 13S officers acquired their space operational experience solely as commanders.

This practice may be expected to change over time, however, as larger shares of younger officers acquire space operational experience. Beginning in the mid-1980s, about one in every six officers joining the force began his or her career in satellite C² operations, and about another 10 percent in one of the other three space missions (launch, surveillance, and warning). At the same time, officers who began as missile crewmen were also encouraged to gain experience in space systems. As a result, more than 75 percent of 2001's majors had operational experience in one or more space systems, compared to fewer than 60 percent of the colonels, most of whom acquired such

Table 3.3
How O-5 and O-6 13S Core Officers Had Acquired Operational Experience
(percent)

Mission Area	O-5			O-6		
	As Crew or Staff	As Commander	Total	As Crew or Staff	As Commander	Total
Satellite C ²	24	6	30	12	8	20
Spacelift	15	4	19	7	14	21
Surveillance	6	4	10	3	10	13
Warning	4	2	6	3	3	6
Surveillance and warning	28	4	32	24	16	40
Missile	68	3	71	78	2	80

SOURCE: AFPC historical personnel data.

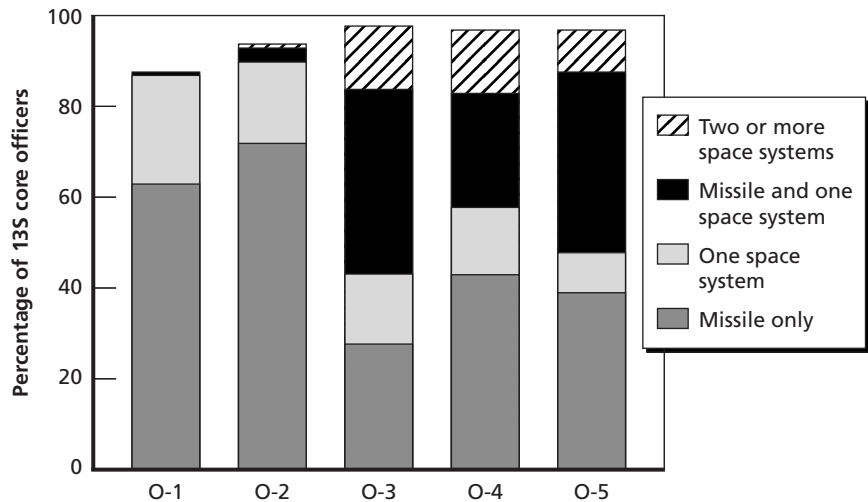
NOTE: All data as of FY 2001.

experience as commanders, not as crewmembers (Figure 3.2). In particular, when 20 percent of O-6s had experience in satellite C², more than 40 percent of O-4s had experience in this area (see Appendix C). As the squadron and wing commanders of tomorrow, these officers are much more likely than recent commanders to have gained operational experience in the space systems they will oversee.

Depth of Tactical Operational Experience

While depth of tactical expertise in a system is regarded as essential for career development, the Air Force has not specified the length of time required to acquire this depth. In practice, the time officers spend acquiring tactical operational experience varies greatly, depending on the mission area. Officers with missile experience spend more than five years on average in this mission area, about two to three more years more than the average officer spends in any one of the space mission areas (Figure 3.3). Few officers spend less than two years in missiles, and two out of three spend more than five years. This pattern reflects Air Force policy, which generally requires at least four years of crew experience in missiles.

Figure 3.2
Distribution of 2001's 13S Core Officers, by Type and Combination of Operational Experience and by Grade



SOURCE: Table C.3, Appendix C.

NOTE: Operational experience acquired by time of promotion to next grade.

RAND MG382-3.2

In contrast, officers with experience in satellite C² had an average 3.5 years in this mission area. And a significant share of them had spent less than two years, especially among the O-6s and O-5s. The rule is to spend at least three years in this mission area.

In the other space mission areas, including spacelift, surveillance, and warning, officers had an average of 2.5 years experience or less. The majority of officers with experience in one of these mission areas had less than two years experience in operating these systems.

Over his or her career through O-6, a 13S core officer had gained an average 6.3 years in one or more operational mission areas, spending about one-third of his or her career gaining operational experience (Table 3.4). Naturally, most such experience was acquired

Figure 3.3

Percentage of 2001's 13S Core Officers, by Length of Operational Experience and Average Time in Specific Mission Area and by Grade

Operational experience	Grade ^a	Percentage officers with experience	Average years	Percentage of officers with specified length of experience		
				1–2 years	3–4 years	5 or more years
Missile	O-2	75	3.1	11.9	85.6	2.5
	O-3	69	5.0	4.6	36.5	58.4
	O-4	69	5.4	6.6	30.4	63.0
	O-5	80	5.2	12.1	31.6	56.3
Satellite C ²	O-2	14	2.9	27.8	72.2	
	O-3	41	3.5	20.7	59.6	19.7
	O-4	22	3.6	33.0	37.7	29.3
	O-5	11	2.4	70.4	25.9	3.7
Spacelift	O-2	2	2.4	46.7	53.3	
	O-3	16	2.6	46.5	50.4	3.1
	O-4	13	2.7	38.3	56.7	5.0
	O-5	6	2.6	59.1	31.8	9.1
Warning	O-2	2	2.5	48.8	51.2	
	O-3	9	2.0	75.7	24.3	
	O-4	4	2.0	76.5	23.5	
	O-5	3	2.3	57.1	42.9	
Surveillance	O-2	2	2.2	52.0	48.0	
	O-3	11	2.3	59.8	31.5	8.7
	O-4	6	2.4	50.0	46.9	3.1
	O-5	3	1.7	95.2	4.8	
Surveillance and warning	O-2	3	1.8	83.8	16.2	
	O-3	19	2.3	63.9	29.3	6.8
	O-4	29	2.3	62.5	30.0	7.5
	O-5	37	2.4	56.1	35.1	8.8

SOURCE: AFPC historical personnel data.

^aData as of time of promotion to next grade.

RAND MG382-3.3

Table 3.4
Average Years of Operational Experience
by System Type and by Grade

Grade ^a	Operational Experience			Total
	Missile Only	Space Only	Missile and Space	
O-2	3.2	3.0	3.4	3.2
O-3	5.7	5.1	7.8	6.4
O-4	5.7	5.1	8.2	6.2
O-5	6.0	4.5	7.3	6.3

SOURCE: AFPC historical personnel data (2001).

^aAs of promotion to next grade.

in the first 12 years of his or her career, at the lieutenant and captain levels.²

The cumulative length of operational experience varies depending on the type of systems involved. Officers with space experience acquired an average five years; those with missile experience averaged about six years; and those with both space and missile experience averaged about eight years.

Career Development

As we noted in Chapter One, the Air Force provides only limited guidance concerning the preferred career paths or steps for reaching a rank or attaining a position. Indeed, over the years, different leaders have provided different and sometimes conflicting guidance in this respect. In this section, we describe the range of career paths space and missile officers have followed. Before doing so, however, we first outline our framework for describing career paths.

² This average excludes the additional time officers may spend as commanders of a unit operating a space or missile system.

Framework for Describing Career Paths

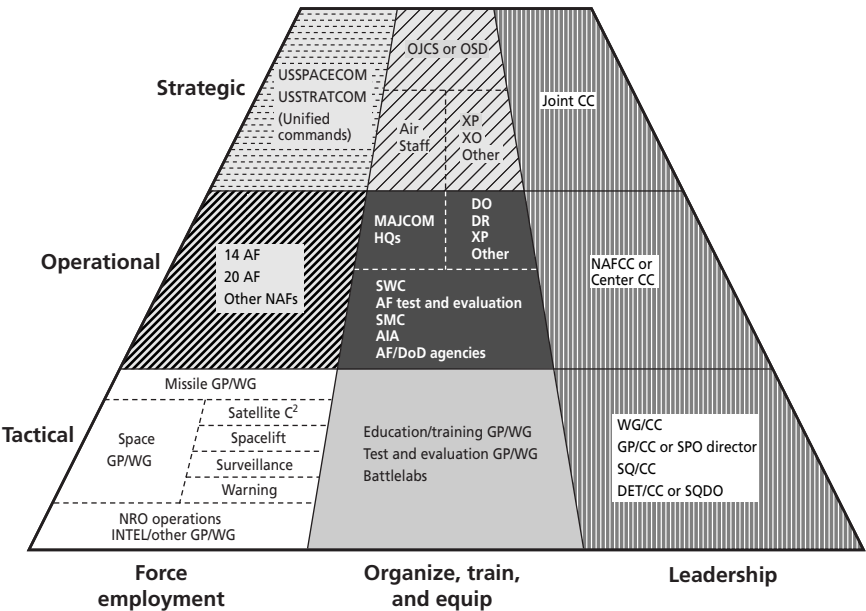
Potentially, officers can follow nearly an infinite number of career paths through the more than 3,500 positions that are open to them. If these paths were described at the job level, it would be exceptional for two officers to go through exactly the same sequence of positions throughout their careers. To be able to characterize career development in more-general terms, we grouped these thousands of jobs into 36 types of career experience, then grouped these into nine aggregate career dimensions. Each dimension represents a different mix of experience and expertise.³

Figure 3.4 presents the key characteristics of the aggregate career dimensions. Vertically, the jobs are distinguished by whether they are primarily **tactical** (at the bottom), **operational** (in the middle), or **strategic** (at the top). Horizontally, they are further divided according to whether they involve **force employment** (i.e., warfighting activities); **organizing, training, and equipping** (i.e., activities in support of force employment); and **leadership** (i.e., command activities from squadron leadership up).

The 36 types of career experience are intended to represent more-specific types of expertise. For instance, jobs in the “tactical and force employment” aggregate career dimension are further divided according to the type of system operated—missile, satellite C², space-lift, surveillance, warning, NRO, and intelligence and other operational activities at the wing level and below. In the “operational and support” aggregate, jobs are further divided among AF/DoD organizations, centers, and various MAJCOMs (including AFSPC, for example). Jobs at MAJCOMs, unified commands, and the Air Staff are further distinguished as being in current operations, plans and programs, requirements, and “other.”

³ These career dimensions were developed with the assistance of a senior Air Force 13S core officer. Two of the aggregated career dimensions are open only to O-7s and above and, hence, are not considered in this study.

Figure 3.4
Career Dimensions and Experience Used to Describe the Career Paths of 135 Core Officers

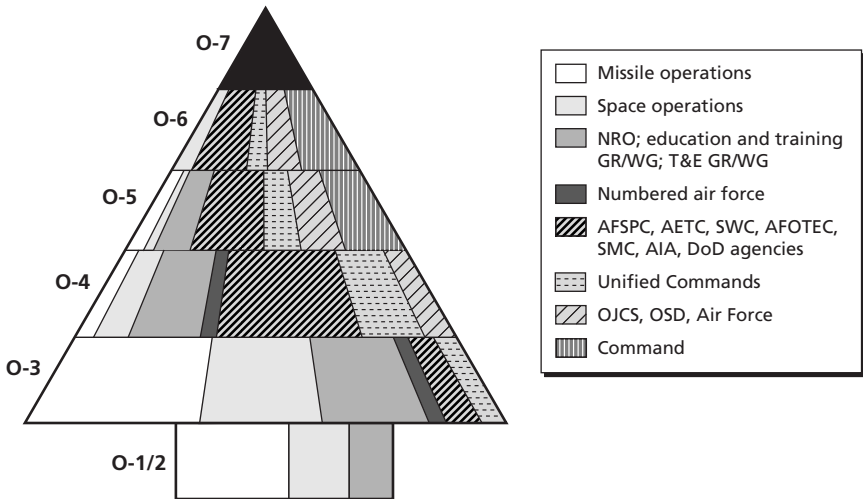


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Opportunities for Career Development

Opportunities for gaining experience in specific career dimensions depend on the number of positions authorized within the grades. Figure 3.5 illustrates these relative opportunities in the form of a modified pyramid. The width of each group of career dimensions at each grade represents the relative number of jobs authorized within each dimension. For instance, at grade O-3, the largest share of jobs is for tactical (primarily missile crew) jobs, and few jobs are authorized for operational and strategic jobs, such as at HQ AFSPC and at the unified commands. In contrast, the largest share of jobs open to majors is in the operational dimension at MAJCOMs, especially at HQ AFSPC, and a notable share of strategic positions is available at unified commands.

Figure 3.5
Opportunities to Acquire Experience, by Career Dimension



SOURCE: Air Force 2001 authorizations.

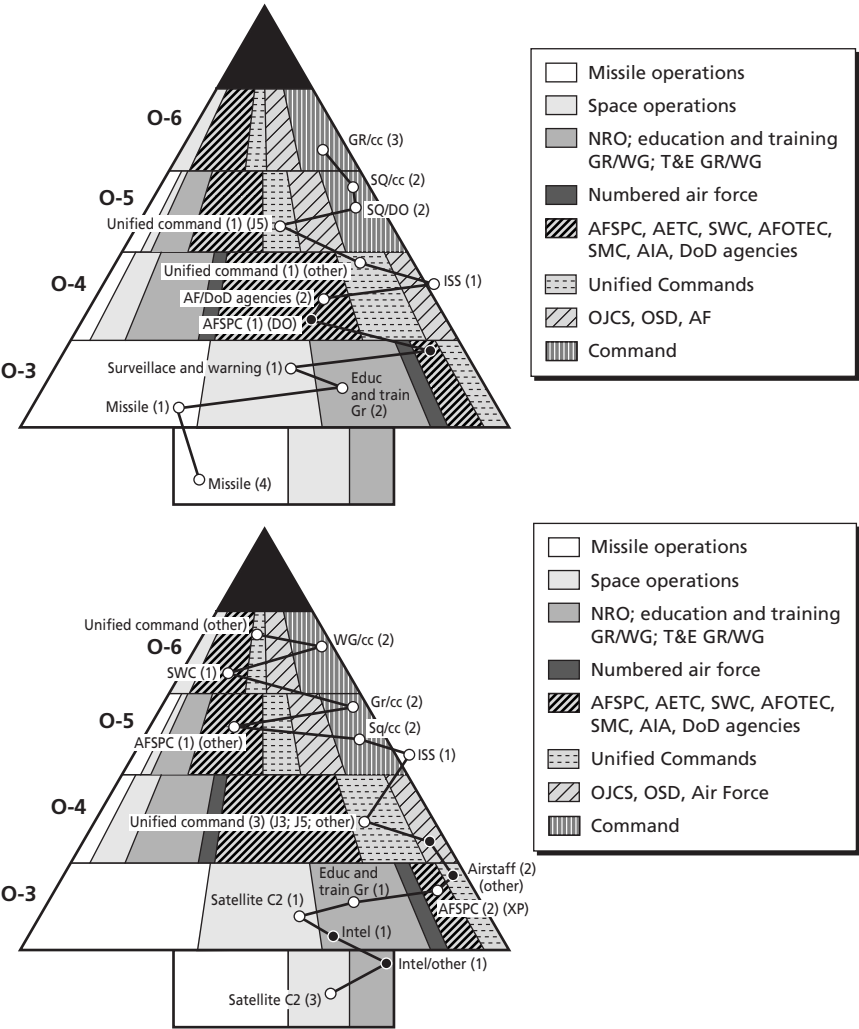
NOTE: Some career dimensions with few positions have been grouped. The sizes of boxes at each grade are proportional to the number of 135 positions authorized in that grade and career dimension. Authorized FY 2001 135 positions and other positions typically occupied by 135 officers are as follows: O-1/2 = 447; O-3 = 1,485; O-4 = 760; O-5 = 484; O-6 = 166.

RAND MG382-3.5

Individual Career Paths

We identified the career paths of all officers on active duty in 2001. Figure 3.6 illustrates the career paths of two of these officers, both colonels with 25 years of service. The first officer (at the bottom of Figure 3.6) held 13 different jobs throughout his career, acquiring experience in seven career dimensions. The officer's career started with seven years in tactical operations, first in satellite C², then in intelligence and other, then back for one year in satellite C². As a captain, he spent one year as an instructor in an education and training group before spending two years in plans and programs at AFSPC and three in acquisition at the Air Staff. As a major, he was

Figure 3.6
Actual Career Paths of Two 13S Core Officers



SOURCE: AFPC historical personnel data.
NOTE: Numbers in parenthesis indicate number of years in the job.
RAND MG382-3.6

assigned to a unified command, where he held three different jobs, including one in current operations and one in plans and programs. After completing intermediate service school in his first year as a lieutenant colonel, this officer spent six years in three successively more-responsible command positions (as squadron, group, and eventually wing commander), interrupted by two one-year assignments, one at HQ AFSPC and the other at SWC.

The second officer (top of Figure 3.6) also started in tactical operations, first in missiles for five years and then in surveillance and warning for one year, after completing two years as an instructor in an education and training group. As a captain, he spent two years in current operations at HQ AFSPC. As a major, he was assigned to an AF/DoD agency and completed intermediate service school, then was assigned to a unified command for three years in plans and programs and then in current operations, including two years as a lieutenant colonel. He then followed three increasingly responsible command assignments, the last one as a group commander.

Were we to plot the career paths of all current O-6s in the same manner as the two in Figure 3.6, each career path would be somewhat different, and every officer's path would be distinct in at least one career experience.

Career Experience Acquired Over Time

To help identify the patterns in career paths, Table 3.5 shows the percentage of officers with experience in key career dimensions and experience by grade, along with the cumulative average duration of each experience. The career dimensions are grouped according to operational mission and then function. As noted earlier, most new officers first gain experience in the operations of space and missile systems, spending most of their time as lieutenants in this realm. Few lieutenants acquire experience in any other career dimension.

During captaincy, officers typically add another three years experience in operations, and about one-third acquire experience in education and training, spending an average of two years in that career dimension. Career paths also begin diversifying into other

Table 3.5**135 Core Officers with Specified Experience and Amount, by Career Dimension and Grade, 2001**

	O-2		O-3		O-4		O-5	
	%	Years	%	Years	%	Years	%	Years
Force Employment								
Tactical								
System operations	94	3.2	98	6.4	97	6.2	98	6.3
NRO	0		6	2.1	5	3.0	10	3.2
Operational								
Numbered air force	1	2.0	14	2.1	28	2.1	30	2.4
Strategic								
Unified command	1	1.9	16	2.0	39	2.4	33	2.4
Organize, train, equip								
Tactical								
Education and training	NA		33	2.2	47	3.4	53	2.9
Test and evaluation	0		11	2.7	10	1.9	5	1.6
Battlelab	1	2.4	2	2.7	2	3.4	1	2.0
Operational								
Space Command	1	1.3	23	1.9	56	2.7	68	3.0
SMC	1	2.0	7	1.6	10	3.3	16	3.7
Centers	0	1.6	8	2.2	6	2.5	5	3.3
AF/DoD agencies	1	2.2	8	2.1	14	2.5	18	2.5
Strategic								
AF staff	0		2	1.3	20	2.2	41	2.9
OJCS/OSD	0		1	2.3	11	2.3	36	2.7
Leadership								
Det/CC or Sq/DO	0		4	1.7	34	1.7	37	1.7
SQ/CC	0		0		0		76	1.6
GR/CC	0		0		0		27	1.6

SOURCE: AFPC historical personnel data; blanks mean not applicable; NA means not available because a change in coding assigned a 135 AFSC to officers still in school or basic training.

NOTE: Career dimensions acquired by time of promotion to next grade.

^aIncludes missile group or wing, space group or wing, and intelligence or other group or wing.

^bIncludes AIA, SWC, AFOTEC.

areas. Officers begin to gain staff experience in support and planning activities at HQ AFSPC (23 percent), in T&E (11 percent), at SMC (7 percent), and/or at other AF/DoD agencies (8 percent). Others gain operational experience at the headquarters of a numbered air force (14 percent) or strategic experience at a unified command (16

percent). The average time spent in these career dimensions varies from a low of 1.5 years to a high of 2.5 years.

At grade O-4, the share of officers gaining experience in some career experience doubles, with more than one-half the majors having experience at AFSPC and about one-third at the headquarters of a numbered air force or at a unified command, respectively. Typically, however, officers do not gain greater *depth* of experience in any of these career dimensions. At this grade level, some officers also begin to gain leadership experience as squadron operations officers (34 percent) and/or strategic experience at the Air Staff (20 percent) or OJCS (11 percent).

Most (76 percent) of the lieutenant colonels gain leadership experience as squadron commanders and some (27 percent) as group commanders (or deputy commanders). The share of these officers having acquired strategic experience at the Air Staff doubles, and the share of those with experience in OSD or OJCS triples (to 36 percent). Experience in these career dimensions averages about three years.

Aggregated Career Paths

While nearly every officer's career path is unique, the data presented in Table 3.5 suggest that these paths can be aggregated into a limited set of possibilities by considering the seven career dimensions (or groups of dimensions) acquired most frequently and grouping them as follows:

- force employment experience in
 - system operations or NRO
 - a numbered air force
 - a unified command
- support, training, and planning experience in
 - education and training and/or T&E, battlelab
 - support operational staff (including AFSPC and centers)
 - Air Staff or OJCS and/or OSD
- leadership experience at the squadron or group levels.

Table 3.6 uses this framework to describe the ten career paths traveled most frequently at each grade level. Three main observations can be drawn. First, these career paths account for more than 50 percent of the officers at each grade level. Second, the number of separate career paths increases with grade, as should be expected. Through captaincy, officers follow 18 different career paths, with as many as 180 officers following the most-numerous career path and as few as seven following the tenth-most-numerous career path. By the time lieutenant colonels are promoted to O-6, they have followed 55 different career paths, with 22 having followed the most-numerous career path and just five officers having followed the tenth-most-numerous career path. And third, the number of career dimensions acquired varies broadly within each grade. By completion of grade O-5, for example, some officers (19 percent) had acquired experience in as few as three aggregated career dimensions, and others (12 percent) had acquired as many as six. Only 1 percent had acquired experience in all seven. Most officers acquire either four (30 percent) or five (37 percent) career dimensions. In addition, the following grade-by-grade observations about career paths should be noted:

- **Grades O-1 and O-2:** Just two career paths account for 95 percent of officers at these two grades.
- **Grade O-3:** By completion of captaincy, nearly 40 percent of officers have acquired no career dimensions in addition to any they had at the earlier grades (although they may have acquired experience in additional space or missile systems). Another 30 percent add experience as operational-level support staff, and about 10 percent add experience at a unified command. Overall, six career paths account for 76 percent of officers through O-3.
- **Grade O-4:** At this grade, a large share of the force adds experience as operational-level support staff and at a unified command, and some begin to acquire experience at the Air Staff, OSD, or OJCS or as squadron DOs. Ten career paths account for 50 percent of the officers. By this point, officers have usually acquired experience in three or four of the seven aggregated career dimensions.

Table 3.6

Most Frequent Combinations of Aggregated Career Dimensions Acquired by 2001's 13S Core Officers, by Grade

Grade Completed	Tactical		Operations		Strategic		Leadership	% of Officers	Combinations (no.)
	System Ops	Ed & Tr, T&E	NAF HQ	Support Staff ^a	Unified Cmds	Air Staff, JCS, OSD	Cmd		
O-1, O-2 N = 1342								63	14
								32	
O-3 N = 787								23	18
								15	
								15	
								14	
								4	
								4	
								3	
								3	
O-4 N = 421								9	62
								6	
								6	
								5	
								5	
								5	
								4	
								4	
								4	62
								3	
O-5 N = 156								14	55
								7	
								5	
								5	

Table 3.6—Continued

Grade Completed	Tactical		Operations		Strategic		Leadership	% of Officers	Combinations (no.)
	System Ops	Ed & Tr, T&E	NAF HQ	Support Staff ^a	Unified Cmts	Air Staff, JCS, OSD	Cmd		
O-5 (cont.)								5	55
								5	
								4	
								4	
								3	
								3	

SOURCE: AFPC historical personnel data.

^aIncludes AFSPC, CAF, SMC, AIA, AFOTEC, and various Air Force and DoD agencies.

- **Grade O-5:** Experience as a squadron and/or group commander is the main addition at this grade. Many officers also gain experience at the strategic level, typically either at a unified command, the Air Staff, OSD, or OJCS. By this grade, officers have accumulated experience in three to six aggregate career dimensions.
- **Grade O-6:** After four years as colonels, most officers have acquired additional command experience, and about two in five have acquired strategic-level experience at both a unified command and the Air Staff, OSD, or OJCS. By then, eight career paths account for 60 percent of these officers. Most have experience in five of the seven aggregate career dimensions.

Differences in Career Development Between Space and Missile Officers

Generally, there are few differences in the combinations, shares, and durations of backgrounds in the various career dimensions between officers who have acquired background in only space, only missile, or both space and missile operations (see Appendix C). Notable differences are summarized below.

Officers with backgrounds in space operations only are significantly more likely to be assigned to NRO, SMC, and other specialized centers, such as the battlelabs, as would be expected. By contrast, officers with experience in missile operations only or in both space and missile operations are more likely to be assigned to T&E and education and training squadrons and groups.

Officers with experience in both space and missile operations generally spend one or two more years on the average accumulating operational experience.

Although we found some differences in retention rates in the early years of service between officers who began in space operations and those who began in missile operations, the space officer cohorts are too small to permit us to draw a firm conclusion (see Table 3.7). In the sixth year of service, space officers were 7 to 10 percent less likely to have remained in the Air Force than were missile officers. As

Table 3.7**Retention Rates of Officers, by Year, Cohort, and Type of First Operational Experience (percent)**

Year from Entry	1975 Cohort		1980 Cohort		1983 Cohort		1990 Cohort	
	Missile	Space	Missile	Space	Missile	Space	Missile	Space
1	100	100	100	100	100	100	100	100
5	78	71	86	80	84	91	90	86
10	64	64	76	59	50	40	70	59
12	63	61	68	57	42	31	63	50 ^a
15	51	61	45	35	31	19	—	—
17	46	61	40	29	29	19 ^a	—	—
20	35	43	28	24	—	—	—	—
22	24	14	19	14 ^a	—	—	—	—
25	15	14	—	—	—	—	—	—
27	7	7 ^a	—	—	—	—	—	—
N	300	14	459	51	587	124	194	70

SOURCE: AFPC historical personnel file.

^aAs of 2001, the last year of observation for the respective cohorts.

years of service increase, the probability of space officers remaining in the Air Force continues to decrease relative to that of missile officers. By the 17th year of service, space officers were about 30 percent less likely to have remained in the Air Force, but retention rates appear about the same thereafter.

Finally, there were no significant differences in promotion rates. Over the past 25 years or so, officers starting their careers in space operations have been as likely as missile officers to be promoted to first lieutenant but slightly less likely to be promoted to captain (90 versus 94 percent on average) and to major (75 versus 78 percent). However, given the relatively few officers who started in space operations, these differentials translate into only one or two fewer officers being promoted annually than if they were promoted at the same rate as officers starting in missile operations. On the other hand, space officers are slightly more likely to be promoted to lieutenant colonel and colonel than missile officers. Again, however, the differential in promotion rates is small, translating to no more than one additional space officer being promoted annually to grades O-5 and O-6, respectively, than would otherwise be the case (see Appendix C).

Conclusions

It is possible to identify the educational, training, and job experience 13S core officers accumulate at every stage in their careers and in the same terms as used to characterize job requirements. We will use this information, along with the job requirements described in Chapter Two, to assess gaps in 13S officer preparation in the next chapter. In addition, the Air Force could apply the algorithm we have developed to personnel records to trace the experience an individual officer has accumulated to help guide his or her future assignments.

Although the Air Force's *Officer Career Path Guide* (AFPC, undated) designates no definitive, concrete steps for attaining each rank or position, there are similarities in the types of tactical, operational, strategic, and leadership experience officers acquire at each step in their careers. Virtually all officers begin by acquiring six or more years of tactical operational (crew) experience in one or more of the space or missile systems; by the time they are promoted to O-5, nearly all have acquired three or more years of support and planning staff experience at AFSPC, another MAJCOM, or an Air Force center. Most officers promoted to O-6 have also acquired an average two years of experience as squadron and/or group commanders. Together, these types of experience account for about one-half of an officer's career.

In addition, 13S space and missile officers typically acquire one or more of the following four additional types of experience: About one-half acquire an average two years of experience in instruction or in standardization and evaluation early in their careers; about one in ten acquires operational experience at HQ 14th or 20th Air Force; and about one-half acquire up to three years of strategic experience, generally later in their careers, either in force employment at a unified command (typically USSTRATCOM or USSPACECOM) or in support (at OSD or OJCS), but rarely both.

With respect to space tactical operational experience, about two-thirds of 13S officers acquire experience in missile crews, and this share has remained relatively stable over the years. By contrast, and as the number and complexity of space systems have increased, the share

of officers with space experience has increased steadily. While about 20 percent of 2001's colonels had experience in one or more space systems, more than 70 percent of the majors had such experience. The majority had both missile and space experience. As a result of this trend, the historical high frequency of space units being commanded by officers lacking experience in their unit's type of operations will diminish, along with the concerns that this practice has raised.

A majority of O-5 officers had gained four or more years of experience in missile operations and three or more years in satellite C². In contrast, the majority of officers had less than two years of experience in spacelift, surveillance, or warning. We did not investigate whether these lengths of experience are sufficient to develop full proficiency in the operations of any one of these systems.

There is a great deal of variety in the type of functional experience officers acquire. About three in four O-5 and O-6 officers have experience in current operations and/or plans and programs. About one in four of these officers has experience in requirements, acquisition, and/or political-military. Finally, about one in ten has experience in intelligence, communications, T&E, and/or R&D.

Even though technical education is deemed critical or important for only a small share of positions, as we saw in Chapter Two, the share of officers with some type of technical education has increased over time. In 2001, one out of three colonels had such an educational background, while more than one out of two majors did. Contrary to a widely held perception, we found no evidence that officers with a technical background have been more likely to leave the force than other officers over the past 15 years.

Finally, officers with space backgrounds have been just as likely to be promoted as have officers with missile backgrounds. The perception that space officers were less likely to be promoted than missile officers is likely due to the fact that there were many more of the latter than the former.

Gaps Between Supply and Demand

This chapter compares the backgrounds needed for space and missile jobs (Chapter Two) with the cumulative backgrounds of 13S core space and missile officers active in 2001 (Chapter Three) to identify potential gaps in their career development.¹ We identify backgrounds in short supply in three ways: (1) background by background for the space and missile force as a whole; (2) by background combinations, again for the force as a whole; and (3) by comparisons of officers' backgrounds to those needed for the jobs they filled in FY 2001. Gaps identified in this last assessment may be due to both career developmental gaps and the misallocation of officers to jobs.

In interpreting the gaps identified in this section, readers should keep in mind that this assessment is quantitative; it assesses whether enough officers have developed the backgrounds needed for the jobs. We do not address the qualitative question of whether the officers are proficient at the tasks they are asked to perform in the various jobs.

Specific Backgrounds in Short Supply

Supplies of individual backgrounds that fall short of demand are relatively few and are mostly at the O-6 level (see Table 4.1). But when

¹ To determine gaps, we compared the backgrounds the jobs at each grade require with those that officers at the same grade had accumulated up to, but not including, the job they were holding in 2001 (see Appendix D).

Table 4.1
Gaps Between Experience FY 2001 13S Officers Had
Acquired and What 13S Jobs Need (percent)

Background	Grade		
	O-4	O-5	O-6
AFS prefix			
R = Contingency and war planner	-4	-2	-14
S = Safety officer	-2	-1	-5
W = Weapons and tactics instructor	-8	-4	-6
Functional			
Requirements	—		-15
Research and development	—	-2	-11
Acquisition	—	-2	-5
Test and evaluation	-2	-2	-13
Organization			
14th Air Force	-4	-7	-14
20th Air Force	-5	—	-2
AFSPC	—	-7	-26
NRO	-3	-10	-10
SMC	—	—	-4
SWC	—	-4	-6
Air Staff	-9	—	-7
OJCS/OSD	-7	-1	—

SOURCE: Tables 2.3 and Appendix D.

NOTES: Only backgrounds with a deficit between the 13S officer supply and the 13S job demand are listed in the table; a dash indicates that the supply equals or exceeds the demand. Backgrounds officers acquired before entering the latest job are described in Appendix D and differ from those shown in Table 3.1 because the latter include the backgrounds acquired during an officer's last job.

they do exist, the gaps are significant, with the supply falling short of the demand by more than 50 percent. Such gaps *currently* exist for certain Air Force specialty prefixes, functional requirements, and organizational requirements.

Air Force Specialty Prefixes: R, S, and W

Officers with experience as contingency and war planners (R) and as weapons and tactics instructors (W) fall short of the demand at grades O-4, O-5, and O-6. The gaps are particularly large at O-6, at which the share of officers with war planning experience would have to

increase to 20 percent from 6 percent and of those with experience in weapons and tactics to 6 percent from none in 2001 (see Table 2.3 and Appendix D). Coding conventions and lack of a program in the Weapons School precluded accumulation of these types of experience until the mid-1990s, explaining the relatively large size of these gaps. Since then, the share of officers acquiring experience in either one of these areas has increased steadily (see Appendix D). For instance, the respective shares of O-4, O-5, and O-6 officers having held the R prefix increased every year from 1 percent in 1995 to 8 percent in 2001. The increase in the share of officers with experience in weapons and tactics was equally large for O-4s, but more modest for O-5s and nil for O-6s.

If the upward trend in the share of officers obtaining experience in war planning continues, the gap in officers with this background should be filled within the next three or four years for O-4 and O-5, but it will take nearly ten years to fill the gap at the O-6 level. The Air Force may consider accelerating the acquisition of this background at the O-4 and O-5 levels now to ensure that enough O-6 officers will have this background in the near future. Similarly, the current upward trend in officers' acquisition of weapons and tactics experience is also unlikely to ensure a sufficient supply of such officers for many years to come. Closing the gap would require providing this experience to 62 more officers at the O-4 level, 17 at the O-5 level, and nine at the O-6 level.

Although the gap in the share of officers with experience in safety (S) is relatively small, decreasing shares of officers have been acquiring this background, so the gap can be expected to increase, most particularly at the O-4 and O-6 levels. Meeting the demand for this background will require reversing the current trend by providing 16 additional officers at grade O-4 or below the opportunity to acquire this experience, and the same to enough officers at O-4 and O-5 to ensure that eight more will possess this experience when promoted to O-6.

Functional Experience

There is also a need for more officers with experience in intelligence, acquisition, requirements, R&D, and T&E, particularly at the O-6 level, at which the gaps range from eight officers for acquisition to 23 for requirements and 20 for T&E. Recent trends in the development of these backgrounds offer mixed prospects for their being filled without some action being taken. The share of officers with experience in R&D and/or T&E either has decreased or has remained stable at the O-4, O-5, and O-6 levels over the past 15 years. By contrast, the share of O-6 officers with experience in acquisition has nearly doubled over the last five years. Similarly, the share of officers with experience in requirements has steadily increased at all grades. If these trends continue, the gap at the O-6 level for these two backgrounds should be mostly filled within the next five years or so.

Organizational Experience

Gaps between the supply of and demand for various organizational backgrounds are also largest at the O-6 level, particularly for experience at AFSPC, the 14th Air Force, and NRO. For the last, there is also a large gap at the O-5 level. These gaps and the smaller gaps observed for experience at the 20th Air Force, the Air Staff, and OJCS and/or OSD are unlikely to be filled without some form of action because the shares of officers with these types of organizational experience have been either steady or trending downward.

The shares of officers with experience in the 14th Air Force and SWC have increased rapidly. These two organizations were established in the mid-1990s. If these upward trends continue, the gaps in these backgrounds should be filled within the next few years, at least partially.

Technical Education

As noted earlier, there are concerns that the current force of 13S core officers does not have the technical education needed to participate in the development, testing, and operations of the next generation of space systems, which is expected to be increasingly complex (see

Chapter One). Table 4.2 compares the shares of O-4, O-5, and O-6 jobs that require a technical education with the shares of officers who hold a degree (bachelor's and higher) in engineering, physical sciences, space operations, or computer science and mathematics. It shows that officers in 2001 who had a technical education in one of these fields exceeded the demand by some 30 percentage points at both the O-4 and O-5 levels. In engineering alone, the supply of officers exceeded the demand by 8 to 17 percentage points.

At the O-6 level, however, the demand for engineers and physical scientists exceeded the supply. But this should be a short-term gap. Ample O-4 and O-5 officers will bring their engineering and other technical degrees as they are promoted to replace their predecessors.

Operational Experience

Similarly, Table 4.3 shows that the shares of officers with experience in the various space and missile mission areas meet the jobs' demands, again with the exception of O-6. This figure compares the shares of jobs specifically requiring missile experience, those specifically requiring space experience, and those requiring experience of either type to the shares of officers possessing these backgrounds.

Large shares of officers have experience in both missile and space missions; if these officers are allocated properly, there will be enough to meet the preferences for these jobs at all grades. Also, and as noted in Chapter Three, an increasing numbers of younger officers are acquiring space operational experience, and as a result, an increasing number of them will have the appropriate systems experience to match with jobs requiring it.

Combinations of Backgrounds in Short Supply

As expected, gaps in the *combinations* of backgrounds that officers acquire relative to those 13S jobs need, as identified in Chapter Two, are more frequent and increase with grade. Officers do not possess the

Table 4.2
Comparison of 13S Officers With and 13S Jobs Requiring a Technical Education, by Type and by Grade (percent)

Technical Education	O-4		O-5		O-6	
	Acquired by Officers	Required by Jobs	Acquired by Officers	Required by Jobs	Acquired by Officers	Required by Jobs
Engineering	25.6	8.0	12.4	5.4	5.6	16.1
Physical sciences	3.0	3.7	5.2	3.4	1.9	4.6
Space operations	11.4	0.3	6.4	0.6	5.1	0
Computer science or mathematics	14.6	0.3	18.3	0.6	17.3	0
Totals	54.8	12.3	42.3	10.0	30.1	20.7

SOURCES: RAND survey of 13S senior Air Force officers for technical education demanded by 13S jobs and AFPC historical personnel data for technical education acquired by 13S officers as of FY 2001.

Table 4.3
Comparison of 13S Officers With and Jobs Requiring Operational Experience, by Mission and Grade (percent)

Technical Education	O-4		O-5		O-6	
	Acquired by Officers	Required by Jobs	Acquired by Officers	Required by Jobs	Acquired by Officers	Required by Jobs
Satellite C ²	44	13	30	13	20	20
Surveillance/ warning	31	11	33	14	42	10
Spacelift	18	5	20	5	21	6
Missile	69	25	69	17	79	20
Subtotal	69	54	53	47	58	56
Any space	69	20	53	16	58	24
Either space or missile	98	18	97	26	97	20
Subtotal	N/A	38	N/A	42	N/A	44
Total	98	92	97	89	97	100

SOURCES: RAND survey of senior 13S core Air Force officers for mission experience preferred for jobs and AFPC historical data for mission experience acquired by officers as of FY 2001.

appropriate background combinations for 9 percent of O-4 jobs, 11 percent of O-5 jobs, and 28 percent of O-6 jobs (see Tables 4.4 to 4.6).² At all three grades, gaps appear primarily for combinations involving a broad set of types of experience, typically backgrounds in current operations and one or more functional areas (typically acquisition, requirements, and/or T&E), NRO or SMC, MAJCOM and/or higher headquarters (Air Staff or OJCS and/or OSD), and technical education.

Gaps in Combinations of Backgrounds for O-4 Jobs

Gaps exist for a small share of O-4 jobs (see Table 4.4). One gap is for needing multiple types of functional and organizational experience, including current operations, plans and programs, and flight command; at a MAJCOM, higher headquarters, and either a unified command or NRO; and technical education. Another gap comes from a group of 20 jobs at SWC and at a couple of T&E squadrons that also require a broad set of core backgrounds, including current operations, group or wing experience, and a MAJCOM, and technical education, plus either higher headquarters, safety, requirements, or T&E experience.

The final and largest gap for O-4 jobs comes from a set of 40 jobs located at USSTRATCOM that, although they require a limited number of functional (current operations) and organizational backgrounds (group or wing and a numbered air force), also require experience either as a contingency and war planner or as nonrated aircrew. Few officers can acquire this broad combination of backgrounds by the time they are senior majors. Meeting these job backgrounds will

² Recall that these comparisons are for the force as a whole at each grade. Although the experience required for 91 percent of the O-4 jobs is matched by that acquired by officers, for example, officers with the right backgrounds may not be assigned to the jobs that need them. This part of our analysis addresses whether the cohorts of officers at each grade have collectively developed the right combinations of background, not whether their backgrounds are being utilized to best advantage.

Table 4.4
Gaps Between What 13S O-4 Officers Have and What 13S O-4 Jobs Need
(percent)

Background Combination	Jobs Needing	Officers Having	Gaps
Current operations, plans and programs, flight/CC, MAJCOM, higher HQ			
NRO, technical education	0.8	0.6	-0.2
Unified command	2.3	0	-2.3
Current operations, group or wing, technical education, MAJCOM			
Higher HQ	1.4	1.1	-0.3
Safety, test and evaluation, missile	0.8	0.1	-0.7
Requirements, test and evaluation, surveillance, warning	0.9	0.1	-0.7
Current operations, group or wing			
Instructor, flight/CC, missile	2.9	32.8	None
Instructor, flight/CC	5.8	34.3	None
Contingency and war planner or nonrated aircrew, numbered air force, missile	6.2	1.4	-4.8
Current operations, plans and programs			
Weapons and tactics	1.2	1.3	None
Satellite C ²	2.5	12.7	None
None	1.5	25.7	None
Technical education			
Acquisition, SMC, spacelift	0.9	1.1	None
Acquisition, SMC, satellite C ²	0.8	3.9	None
NRO, surveillance	0.9	2.5	None
None	2.8	30.0	None
Weapons and tactics			
MAJCOM	3.2	6.0	None
None	1.7	6.5	None
Instructor or evaluator			
Missile	5.4	61.6	None
Satellite C ²	0.8	29.2	None
None	2.0	53.0	None
Mission experience only, miscellaneous require- ments			
Satellite C ²	6.5	44.0	None
Spacelift	3.2	18.0	None
Surveillance and warning	7.8	28.1	None
Missile	6.8	70.0	None
None	30.9	100.0	None

SOURCES: RAND survey of senior 13S core Air Force officers for jobs' backgrounds and AFPC historical personnel data for officers' backgrounds as of FY 2001. The groupings of jobs by combination of backgrounds are those shown in Table 2.6.

Table 4.5
Gaps Between What 13S O-5 Officers Have and What 13S O-5 Jobs Need
(percent)

Background Combinations	Jobs Needing	Officers Having	Gaps
Current operations, acquisition, requirements, SQ/CC, SMC or NRO, higher HQ			
Technical education	4.5	0.7	-3.9
Current operations, flight/CC, group or wing, MAJCOM			
Plans and programs, higher HQ	7.6	4.8	-2.8
Acquisition, requirements	3.1	2.1	-1.0
Operations officer	2.3	13.0	None
SQ/CC	4.8	7.6	None
Contingency and war planner or nonrated aircrew, numbered air force	3.4	0.7	-2.7
Instructor, current operations, MAJCOM			
Technical education	3.1	4.2	None
Higher HQ	6.7	5.9	-0.8
Contingency and war planner	2.5	3.3	None
MAJCOM			
Satellite C ²	4.5	20.3	None
Surveillance/warning	7.9	23.7	None
None	2.8	47.6	None
NRO			
None	3.4	4.7	None
Mission experience only			
Missile	10.1	71.0	None
Surveillance, warning	5.1	31.0	None
None	28.2	100.0	None

SOURCES: RAND survey of senior 13S core Air Force officers for jobs' backgrounds and AFPC historical personnel data for officers' backgrounds as of FY 2001. The groupings of jobs by combination of backgrounds are those shown in Table 2.7.

require careful career development, even if these jobs were to be authorized at a higher grade to allow more time for enough officers to acquire the needed combinations of background.³

Gaps for O-5 Jobs

Gaps in the background combinations O-5 officers acquire are similar to those of O-4 officers—i.e., coming from jobs that have multi-

³ We estimate that, if these jobs were reclassified, the gap would remain.

Table 4.6
Gaps Between What 13S O-6 Officers Have and What 13S O-6 Jobs Need
(percent)

Background Combinations	Jobs Needing	Officers Having	Gaps
Current operations, acquisition, requirements, SQ/CC, NRO or SMC, MAJCOM and/or higher HQ			
Technical education	10.3	5.1	-5.2
Test and evaluation	8.0	2.5	-5.5
WG/CC, satellite C ²	2.3	0.0	-2.3
GR/CC	4.5	1.3	-3.2
Current operations, plans and programs, SQ/CC, higher HQ			
NRO	2.3	3.1	None
None	9.2	24.3	None
Current operations, SQ/CC, MAJCOM and/or higher HQ			
Instructor, group or wing	10.3	21.1	None
Group or wing	9.2	21.9	None
Spacelift	5.7	10.2	None
GR/CC, satellite C ²	4.5	5.1	None
SQ/CC, numbered air force, MAJCOM, higher HQ, unified command, technical education	5.7	1.3	-4.4
SQ/CC, missile			
Instructor, current operations	6.9	39.7	None
Instructor, test and evaluation, unified command	3.4	1.9	-1.5
GR/CC	10.3	40.4	None
Contingency and war planner, satellite C ²			
Miscellaneous	6.9	0.6	-6.3

SOURCES: RAND survey of senior 13S core Air Force officers for jobs' backgrounds and AFPC historical personnel data for officers' backgrounds as of FY 2001. The groupings of jobs by combination of backgrounds are those shown in Table 2.8.

ple requirements, typically more than six (see Table 4.5). These jobs need multiple types of functional experience, including current operations, plans and programs, requirements, acquisition, and/or T&E. They also need multiple types of organizational experience, including NRO or SMC, MAJCOM, and/or higher headquarters. Finally, some of these jobs require the special experiences as contingency and war planners or as nonrated aircrew.

As it was for O-4 officers, these combinations of multiple functional, organizational, and prefix experience are difficult to acquire by the time officers are between their 17th years and 22nd years of service. As noted earlier, officers spend an average eight of these years

gaining operational experience in one or more space and missile systems, two years in PME, and two or more years as squadron operations officers and commanders, leaving from five to nine years to acquire experience in these multiple staff functional and organizational areas. Indeed, it is not until promotion to O-5 that a significant share of officers has the opportunity to gain experience in a higher headquarters. Ensuring that enough officers can obtain these background combinations will require deliberate, directed career development starting relatively early in some officers' careers.

Gaps for O-6 Jobs

At the O-6 level, there are gaps in officer preparation for four of the six job groups identified, accounting for one out of every three jobs (see Table 4.6). As is the case for O-4 and O-5 jobs, these job groups need multiple types of functional and organizational experience and, in addition, either squadron or group command experience. Two sets of these jobs also require a technical education. As noted above, acquiring broad combinations of multiple types of experience is difficult unless deliberately planned for selected groups of officers, again starting relatively early in their careers.

Assignment of Officers to Jobs Contributes to the Mismatch Between Supply and Demand

In addition to gaps in officer preparation, the process of assigning officers to jobs can exacerbate the mismatch between job requirements and officer qualifications.

Process of Assigning Officers to Jobs

With officers changing jobs about every two years, if not more frequently, how officers are assigned to successive jobs is critical both for career development and for effectively matching officers' qualifications to those the jobs demand. A few captains and majors at the AFPC facilitate this important task. To help in the assignment decisionmaking process, the requestor for a job to be filled sends AFPC a

description of the job's functions and of the qualifications candidates should have. Descriptions of the qualifications can vary from minimal to elaborate, as reflected in the following examples, taken from various requisitions. In each of the following, *M* means mandatory; *HD*, highly desirable; and *D*, desirable:

- for a captain position at USSPACECOM: "Previous missile experience and Codes experience"
- for a captain position at USSPACECOM: "(M) Space operations experience (HD) Acquisition and contractor interface experience; staffing and/or briefing experience with senior leadership; eligible for TS/SCI clearance (D) Engineering or technical degree"
- for a major position at USSPACECOM: "(M) TS/SCI with current SBI; (M) BS in Engineering Discipline; (D) MSE Engineering Discipline; (D) Air Force laboratory/NRO AS&T knowledge/experience; (D) prior knowledge of/experience in Headquarters AFSPC"
- for a lieutenant colonel position at AFOTEC: "Cmd level experience: MAJCOM (D) and operational Test and Evaluation Experience (D)"
- for a lieutenant colonel position at USSPACECOM: "TSC/SCI elig (must have completed prior to starting job); master's degree completed (either bachelor's or master's must be in aerospace-related field)."

With some frequency, the requestor may have identified the individual officer he or she wants and may request the individual by name whether or not the officer has all the qualifications sought. Typically, AFPC will approve. Another constraint for AFPC may be whether an officer with the requested qualifications will be available at the appropriate time. If such an officer is not available, the requestor may have to settle for someone with fewer or different qualifications than those requested or leave the position vacant. Also, AFPC tries to take individual officers' preferences into account.

This assignment process fills jobs one by one from the pool of officers available when the position needs to be filled and may, as a

result, add to the mismatch between job requirements and officer preparation.

How the Backgrounds of Incumbents Compare with Those the Jobs Need

To assess the potential effectiveness of the assignment process, we compared the qualifications of officers to those for the jobs they held in FY 2001.⁴ Table 4.7 summarizes the results. Overall, only about 15 percent of the jobs were filled by officers who met most (80 to 100 percent) of the job requirements, regardless of grade. About half the jobs were filled by officers meeting 50 percent or more of the requirements. O-6 officers generally met a higher proportion of the jobs' background target (68 percent) than did O-5 and O-4 officers (53 percent). It appears that a more deliberate effort is made to match senior officers to job needs than is made for younger officers.

Table 4.7
Jobs for Which Incumbents' Backgrounds
Met Job Requirements (%)

Met Needs (%)	Grade			All
	O-4	O-5	O-6	
80–100	16	11	6	14
60–79	25	29	43	27
40–59	25	27	37	26
20–39	19	21	14	20
0–19	15	11	0	13
Total	100	100	100	100

SOURCES: RAND survey of senior 135 core Air Force officers for jobs' backgrounds and AFPC historical personnel data for officers' backgrounds as of FY 2001.

NOTE: We could match officers to 817 of the 1,034 135 duty AFSC jobs that were rated for the backgrounds they need.

⁴ This comparison is based on matching 817 of the 1,034 jobs rated for demand requirements. The remaining positions could not be matched to an officer in that year.

As would be expected, the background types most frequently lacking in this assessment overlap with those for which gaps were identified earlier. These include the S and W prefixes; requirements, acquisition, and T&E functional experience; and Air Staff and NRO organizational experience (see Table 4.8). But gaps in career preparation do not fully account for the magnitude of the mismatches observed. For instance, the gap between the share of O-6 jobs needing Air Staff experience and the share of officers possessing this experience is 13 percent, but in 2001, officers without this experience filled 64 percent of the jobs needing it. Similarly, the gap in career preparation for T&E experience is 56 percent, but the mismatch in jobs actually filled in 2001 is 74 percent.

That the assignment of officers to jobs can contribute to the mismatch between jobs and officers is further illustrated by the low rate at which officers with technical education filled jobs needing such an education (see Table 4.8). Earlier, we showed that the supply of officers with technical educations exceeded what is demanded by the jobs, particularly at the O-4 and O-5 levels. But officers with technical educations were assigned to jobs demanding it in less than 60 percent of the cases. Similarly, the supply of officers exceeds demand for experience in current operations, plans and programs, and unified command, but the shares of jobs needing these backgrounds whose incumbents had them were 84, 39, and 40 percent, respectively.

A similar pattern is evident with respect to space operational experience. Jobs needing missile experience were mostly filled by officers with this experience at all grade levels. But jobs needing experience in a specific space system were filled by an officer possessing this experience in only 40 to 56 percent of cases, even though enough officers had the targeted experience. The mismatch was typically larger at the O-6 level than at the O-5 and O-4 levels.

Table 4.8
Jobs for Which Incumbent Officers Have the Background Needed for the Job

Background Needed	Grade			All Three Grades
	O-4	O-5	O-6	
Operations				
Satellite C ²	58	58	42	56
Spacelift	53	29	60	47
Surveillance	69	46	13	55
Warning	41	53	17	44
Missile	93	93	100	93
Any space (no missile)	85	70	57	78
Any space or missile	99	95	75	96
AFS prefix				
C = Commander and B = Squadron operations officer	50	100		
K = Instructor and Q = Standardization and evaluation examiner	78	71	69	75
S = Safety	0	9	0	3
T = Formal training instructor	44	45	0	38
V = Automated functional applications analyst	0	0	0	0
W = Weapons and tactics instructor	15	9	25	14
X = Nonrated aircrew member	24	55	—	34
Functional				
Intelligence	8	26	—	16
Current operations	78	88	92	84
Plans and programs	33	35	76	39
Communications	19	21	0	19
Requirements	21	29	30	26
Research and development	19	26	30	23
Acquisition	11	32	47	25
Test and evaluation	29	21	24	26
Political-military	17	11	—	11
Education and training	53	46	50	50
Organization				
Group or wing	56	77	94	68
Numbered air force	19	12	18	17
MAJCOM	64	76	87	72
AIA	—	—	—	—
DTRA	10	6	—	9
AFTEC	5	10	—	6
NRO	20	18	30	22
SMC	20	16	36	21
SWC	6	5	25	7
Air Staff	6	27	59	24

Table 4.8—Continued

Background Needed	Grade			All Three Grades
	O-4	O-5	O-6	
OJSC or OSD	0	13	38	10
USSTRATCOM or USSPACECOM	41	39	43	40
Command				
Squadron	0	55	90	62
Group	—	29	53	45
Wing	—	—	29	29
Education				
Technical education	57	52	27	53

SOURCES: RAND survey of senior 13S core Air Force officers for jobs' backgrounds and AFPC historical personnel data for officers' backgrounds as of FY 2001.

NOTE: A bar means no positions require the background.

Conclusions

The 13S core officer force largely acquires the backgrounds identified as needed to perform the 13S jobs at grades O-4 to O-6 effectively. In particular, no shortages of technical education or tactical operational experience were identified.

However, some specific individual backgrounds and background combinations have been acquired by too few officers to meet job requirements, especially at the O-6 grade level. Current gaps in officer preparation are primarily for experience working in safety, war planning, weapons and tactics instruction, acquisition, requirements, and/or T&E. Also, too few officers acquire experience in USSPACECOM, 14th Air Force, NRO, and/or SMC. A more-deliberate force-development process appears to be needed to fill these gaps.

Purposeful development, starting early in the career, seems necessary to ensure that enough officers develop the complex backgrounds needed for a small percentage of jobs at O-4 and O-5 and for about one-third of the jobs at O-6. These jobs typically need two or more types of functional experience and experience in multiple organizations, and some also need technical education and/or experience

as a contingency and war planner, weapons and tactics instructor, or both. Such breadth is nearly impossible to acquire by the time an officer is a major and is even difficult for colonels. Within a full-length career of 20 to 22 years, officers spend six to eight years gaining operational background in one or more space and missile systems, two years in PME, and two or more years as operations officers and/or squadron commanders, leaving about ten years to acquire multiple types of staff functional and organization experience. Indeed, it is not until O-5 that many officers have the opportunity to gain experience in a higher headquarters.

The process of assigning officers to jobs also appears to contribute to the mismatch between job needs and officer backgrounds. Appropriate matching of these is often constrained by inadequate specification of the qualifications on the request forms. Standardization of key backgrounds for classes of jobs, as shown in Chapter Two, would alleviate this problem. Another limitation on appropriate matching may also be the availability of officers with the necessary background when a job must be filled. Increasing the numbers of officers with the qualifications needed for any one position can alleviate the latter problem.

Finally, another way to improve the overall match between officers and jobs would be to develop a more-proactive assignment process that fully uses the information available on the experience officers have accumulated and the information on the backgrounds 13S jobs require, such as the one we have developed.

Modeling 13S Officer Development and Utilization

Can the gaps between officer backgrounds and those needed for 13S jobs be reduced? Can assignment selectivity be improved by increasing the numbers of officers qualified for any given job? Can broad “career ladders” be identified for 13S core officers that meet deliberate force development goals? Can officers’ experience be deepened? Is the career field sustainable?

To help address such questions, we developed a flow model that seeks to optimize the development and utilization of 13S officers so that the experience they accumulate matches the needs of their future jobs as closely as possible. Officers progress through successive assignments (jobs), acquiring more experience, broadening their backgrounds, and being promoted or leaving the force. At each career stage of an entering cohort, the model projects the numbers that remain in the force and move into each different group of jobs, keeping cumulative track of the backgrounds they acquire along the way. Most importantly, it seeks to optimize the match between the backgrounds officers have acquired at each step with the backgrounds needed for the jobs they fill. A steady-state optimization model, it simulates the officer flows and long-term inventory that would result if, on average, the same levels of accessions, separations, promotions, and reassignments were repeated year after year.

This chapter describes the key features of the optimization model, the data used to operationalize it, its outputs, and its uses and limitations. In Chapter Six, we will use the model to assess whether it is possible to improve on the match between officer preparation and

job needs and consider alternative officer preparation policies for meeting job needs.

Conceptual Overview

Ours is a Markov model appropriate for linear optimization. In it, officers enter the 13S occupation and progress through up to 13 jobs: two at O-1 and -2; three each at O-3, O-4, and O-5; and two at O-6 (see Figure 5.1). This reflects the average number of different jobs held before retirement as an O-6 or promotion to O-7. After each job or career stage, some officers leave the force (attrition), and others either stay where they are or are reassigned and, at some stages, promoted to the next grade.

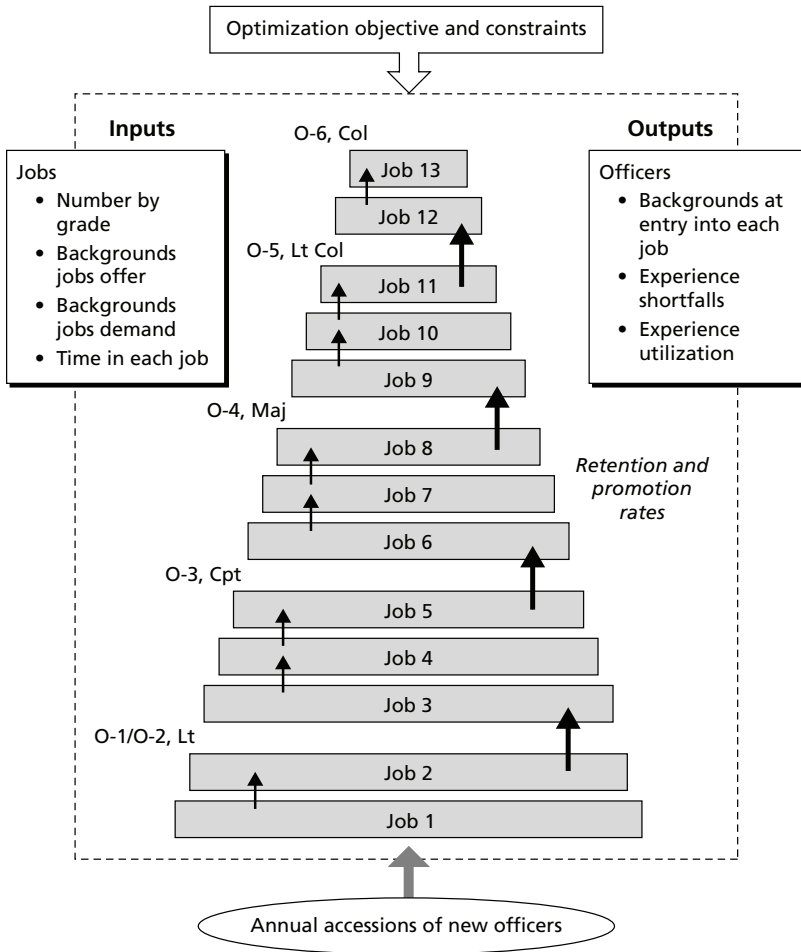
Each job (or group of similar jobs) at each grade is characterized by which of 12 backgrounds an officer gains from holding the job and by which backgrounds an officer needs to perform the job effectively. As discussed in more detail later, the number of backgrounds that can currently be considered is limited by practical limitations in solving the optimization problem.

At the completion of each career stage, officers are credited with the backgrounds provided by their jobs. In turn, the model tries to reassign officers to jobs whose background needs they already meet.

Operationalizing the Model

To set up the 13S optimization model, we must specify a number of parameters: (1) a set of retention rates and job durations, (2) the numbers of jobs at each grade, (3) up to 12 backgrounds that may be gained from or that are needed for each job, and (4) job groups at each grade that uniquely provide each subset of backgrounds and need the same subset of backgrounds.

Figure 5.1
Officer Flows in 135 Career Optimization Model



RAND MG382-5.1

Retention Rates, Accession, and Job Durations

The retention rates and average job lengths currently used in the model are shown in Table 5.1. The retention rates are averages of those observed for 1994 through 1999, adjusted slightly to ensure

Table 5.1
Average Stage (Job) Durations and Retention Rates

Grade	Career Stage	Average Duration (years)	Retention in Next Stage (%)	Percentage of the Force
O-1, O-2	s1	2.00	97.9	14.0
	s2	2.00	76.3	13.8
O-3	s3	2.20	82.9	11.5
	s4	2.20	93.0	9.6
	s5	2.20	99.8	8.9
O-4	s6	2.00	91.8	8.1
	s7	2.00	97.7	7.4
	s8	2.00	84.8	7.2
O-5	s9	2.00	83.4	6.1
	s10	2.00	62.5	5.1
	s11	2.00	57.1	3.2
O-6	s12	2.75	55.2	2.1
	s13	5.25	—	2.9

SOURCE: AFPC historical personnel data.

that the model sustains a force whose grade distribution matches those of the jobs that 13S officers typically fill (see below). To sustain this condition, the model would add 235 new 13S officers to the force annually.

The average job duration was obtained by dividing the average years officers spend at each grade by the average number of jobs held at each grade across successive cohorts of officers.¹

The average retention rates apply to all groups of officers, regardless of their backgrounds.² Similarly, the average job lengths apply to all jobs at the indicated stages. In reality, some officers spend longer in a job than others; retention rates are not necessarily uniform; and the number of jobs held within a grade may vary. How-

¹ These averages were derived from the AFPC historical personnel data described in Chapter Three.

² This assumption was made because, if the Air Force were to guide flows based on patterns developed using such a model, it may be thought unfair for officers progressing through some sequences of jobs to enjoy higher retention or promotion rates than others. This assumption and the model's other inputs can be changed.

ever, the model's application of behavioral rules for all officers and jobs may not be too constraining for our purpose. If the assumption that people move through the system uniformly produces good results, permitting flexible and varied movements should produce equal or better results.

The average job duration reflected in the model is usually shorter than the typical tour length of three to four years. This is because officers may hold more than one job during a tour. For instance, an officer may spend two years in a DO job and then one to two years in an XP job during a tour at AFSPC.

Number of Jobs at Each Grade

The jobs available to 13S officers include all 2,893 13S and associated jobs authorized in 2001 plus 453 additional non-13S jobs that 13S core officers held in 2001. Table 5.2 shows the breakdown of jobs by grade. Officers at any stage within a grade can fill any of the jobs at that grade.

Set of 12 Backgrounds

The set of 12 backgrounds included in the model is smaller than the set of backgrounds considered in earlier chapters. This is because the additional backgrounds make the optimization process, at this stage of its development, too large to permit reasonable solution times (see the next subsection).

Table 5.2
13S Positions Available at
Each Grade

Grade	Number of Positions
O-1, O-2	447
O-3	1,485
O-4	760
O-5	484
O-6	166
Total	3,342

Some of the 12 backgrounds included in the model are aggregates of our original set of backgrounds (see Table 5.3). The 12 include three tactical mission backgrounds (space, missile, and either space or missile), four functional backgrounds (acquisition, requirements, plans and programs, and intelligence and communications), four organizational backgrounds (group- or wing-level instructor and evaluator, MAJCOM or Air Staff, joint staff, and other staff), plus command. Table 5.3 shows the relationship between the original set of backgrounds discussed in earlier chapters and the backgrounds used for the model. For instance, it shows that the joint staff category includes experience in OSD, OJCS, or a Unified Command and that acquisition is broadly defined to include acquisition, R&D, T&E, SMC, and/or AFOTEC.

These backgrounds were chosen in consultation with AFSPC staff to represent key background dimensions that are the most important for 13S officers to acquire. We systematically determined which of the 12 aggregated backgrounds each of the 3,342 jobs in the model would provide, as described in Chapter Three. For backgrounds required by O-4 to O-6 jobs, we aggregated the demand data described in Chapter Two. The result for each job or group of jobs is two vectors of 12 items, one representing what the job “offers,” and one representing what the job “demands.” Each vector can be thought of as a string of binary digits, a sequence of 1s and 0s, each character representing the presence (1) or absence (0) of one of the 12 backgrounds.

Appendix E contains the complete list of jobs with their offer and demand vectors. Table 5.4 shows the shares of jobs that demand and offer each of the 12 backgrounds included in the model. For instance, acquisition experience is needed for 36 percent of the O-5 jobs, while acquisition experience is offered by 10 percent of the O-5 jobs.

Table 5.3
Consolidation of Specific Experiences into 12 Categories

Experience category -->		missile space missile or space acquisition requirements plans, programs comm or intel (group or wing) + (K or Q) majcom, air staff unified cmd, ojcs, oost other staff command											
		Mission			Function			Organization				Cmd	
		1	2	3	4	5	6	7	8	9	10	11	12
		msl	spc	eith	acq	rqt	plpr	ospt	tdr	stf	jstf	ostf	cmd
Mission ops	1 satellite C2		x										
	2 spacelift		x										
	3 missile crew	x											
	4 surveillance		x										
	5 warning		x										
	6 space or missile			x									
	7 any space		x										
AFS prefixes	8 B or C, ops officer or cmdr											x	
	9 K or Q, instr or stan eval							x					
	10 R, war planner												
	11 S, safety												
	12 T, formal training instructor												
	13 V, analyst												
	14 W, weapons & tactics												
15 X, nonrated aircrew													
Function	16 intelligence						x						
	17 current operations												
	18 plans, programs					x							
	19 communications						x						
	20 requirements					x							
	21 research and development				x								
	22 acquisition				x								
	23 test and evaluation				x								
	24 political/military affairs												
25 education/training													
Education	26 technical graduate degree												
	27 technical undergrad												
	28 other graduate degree												
Command	29 flight												
	30 squadron											x	
	31 group											x	
	32 wing/NAF/center											x	
	33 joint											x	
Organization	34 group or wing							x					
	35 NAF										x		
	36 MAJCOM								x				
	37 Air Staff								x				
	38 AIA										x		
	39 NRO										x		
	40 OSD, OJCS									x			
	41 DTRA										x		
	42 SMC				x								
	43 Unified command									x			
	44 AFTEC				x								
45 SWC										x			
Grade	46 same as job												

Shaded backgrounds not specifically registered

Table 5.4
13S Jobs Demanding or Offering Selected Background, by Grade (percent)

Background	Demanding			Offering					Total
	O-4	O-5	O-6	O-1 O-2	O-3	O-4	O-5	O-6	
Missile	25	17	13	63	32	4	10	5	25
Space	49	37	36	24	30	11	14	9	22
Missile or space	26	28	17	87	62	15	24	14	47
Acquisition	28	36	30	3	10	11	10	9	9
Requirements	13	15	23	0	2	11	9	5	5
Plans, programs	22	24	30	0	2	12	19	21	7
Communications or intelligence	8	13	8	1	3	5	3	4	3
Group or wing and k or q	28	20	23	5	4	1	0	0	3
MAJCOM, Air Staff	36	50	43	6	15	36	32	37	22
Unified command, OJCS, OSD	18	32	26	0	2	18	20	18	9
Other organizations	37	31	30	3	10	18	16	14	12
Command	5	31	44	0	0	6	23	30	6

SOURCE: RAND survey of senior 13S core Air Force officers for jobs’ backgrounds.

Groupings of Jobs

We aggregated the 3,342 jobs into groups with unique gain and demand patterns at each grade.³ The jobs exhibit 37 gain patterns, 200 demand patterns,⁴ and five grade groups (we consolidate grades

³ Note that the top three grades’ shares of the jobs (23 percent for O-4, 14 percent for O-5, and 5 percent for O-6, respectively) match Table 5.1’s percentages for a self-sustaining inventory of 13S officers (we adjusted the years in grade and the retention rates in Table 5.1 to yield this match and to simplify the modeling problem), but the bottom grades’ shares do not. Because so many more jobs are authorized for captains than realistic flow rates could fill, we configured the model to fill some O-3 jobs with lieutenants. The overall flow rates yield roughly twice as many lieutenants as the number of jobs authorized for them, so the model uses lieutenants to fill about a third of the jobs authorized for captains.

⁴ To limit the number of demand patterns, we rounded off (to the nearest integer) the maximum demands for specific types of experience in each category. Recall from Chapter Two that we first clustered jobs at each grade into groups with similar (but not necessarily identical) demand patterns; the average demand for a specific experience in such a group (across all jobs in the group) is usually not an integer. Thus, for example, our rounding scheme would rate two clusters as having a critical demand (a value of 3) for joint staff

O-1 and O-2 for the model), but only 311 distinct job groups overall. Most combinations of gain and demand patterns are unique to a grade. The 311 groups average 10.7 jobs but range from 1 to 439 jobs (see Appendix E).

Although the 12 aggregated backgrounds could mean up to 4,096 potentially relevant background profiles, half of these are impossible. This is so because half the combinations of the first three backgrounds cannot coexist—for example, the third digit cannot be 0 (indicating lack of both missile and space experience) if either of the first two is 1 (indicating either missile or space experience, respectively), and the third cannot be 1 (indicating either missile or space experience or both) if the first two are 0 (indicating lack of both space and missile experience). These profiles can thus be omitted, leaving only 2,048 background profiles and the possible transitions among them.⁵ Furthermore, and even though possible in theory, some of these profiles may not be achievable through any sequence of jobs in the 311 job groups we have identified, and some others may be undesirable as waypoints along anyone's career path because they represent background combinations that none of the jobs (or any collection of jobs) along that path demands. The model winnows out these impossible and inappropriate profiles and selects flows so that officers will have desirable and useful profiles at each career stage. Table 5.5 lists

experience if one demanded OJCS and/or OSD and Unified Command experience at levels of 0.4 and 2.6, respectively, and the other at levels of 2.7 and 1.8, respectively. In both cases, the maximum of the two demands rounds to 3.0.

⁵ Input data simply list the background information in each officer profile. For example, profile p0001 contains no experience; p0513 contains only experience in the space mission; profile p1025 contains only experience in the missile mission; profile p1033 contains experience in the missile mission and in a MAJCOM or the Air Staff; and profile p2048 contains experience in all 12 categories. The profile number itself is not important except as a shorthand label for a string of 12 ones and zeroes that reflect the presence or absence of the various categories of experience. Nearly a million ($37 \times 2,048 \times 12$) comparisons are needed to ascertain how the 37 gain patterns, when applied to the 2,048 incoming profiles, will yield officers with given outgoing profiles. We input to the flow model only the results of these comparisons, in the form of a list of incoming profiles, job gain patterns, and corresponding officer outgoing profiles. For example, profile p0001 (reflecting experience in none of the 12 categories) and gain profile gnp01 (which provides experience in the missile mission) yield profile p1025. The input data include 75,776 such triplets.

Table 5.5
Experience Profiles Possible at Successive Career Stages, by Grade and Career Stage

Grade	Career Stage	Possible Entering Profiles (no.)	Experiences (no.)		
			Average	Minimum	Maximum
O-1, O-2	s1	1	0.0	0	0
	s2	24	1.9	0	5
O-3	s3	197	3.7	0	7
	s4	703	5.2	0	9
	s5	1,257	6.2	0	11
O-4	s6	1,422	6.6	0	12
	s7	1,744	6.5	0	12
	s8	1,792	6.4	0	12
O-5	s9	1,792	6.4	0	12
	s10	1,792	6.4	0	12
	s11	1,792	6.4	0	12
O-6	s12	1,792	6.4	0	12
	s13	1,792	6.4	0	12

the numbers of profiles possible at the beginning of each of the 13 career stages modeled, assuming that each officer enters with none of the 12 backgrounds. The model ascertains these counts by excluding the profiles that no combination of existing preceding jobs could create before each career stage.⁶ During its optimization phase, the model then selects for each career stage relatively few profiles (and the mix of those profiles) as waypoints toward subsequent jobs and career stages.

Key Assumption

Currently, the model requires officers to hold the grade authorized for every job they fill, except for lieutenants. Because nominal reten-

⁶ For example, profile p2048, reflecting experience in all 12 categories, is impossible to achieve within the first several career stages. The model builds up the counts in Table 5.5 sequentially by applying the gain patterns available at each stage to the profiles possible when entering that stage. Note that, even though Appendix E reflects only 11 different types of jobs authorized for lieutenants, Table 5.5 indicates that 24 different profiles are possible at the beginning of the second career stage because we let the model use lieutenants to help fill the 24 different types of O-3 jobs.

tion and promotion rates provide too few captains to fill the O-3 jobs, the model must fill some O-3 jobs with lieutenants.⁷

The Optimization

As noted, the model maximizes the match between the backgrounds officers acquire and the backgrounds the jobs demand. We use the General Algebraic Modeling System (GAMS) programming language and the Cplex optimization package to solve this optimization problem (see Brooke, Kendrick, and Meeraus, 1992).⁸

Mathematical Expression of the Optimization Model

The model can be written using only a few mathematical expressions.

$FLOW_{gnp, dmp, s, p, p'}$ is the number of officers per year entering stage s with experience profile p and serving during that stage in a job that demands the types of experience reflected in a *demand* pattern, dmp , and that provides (or offers) types of experience reflected in a *gain* pattern, gnp , that will take their accumulated experience to profile p' .

The optimization has two fundamental kinds of constraints. The first ensures that all jobs are filled:

$$\sum_{s \in S(g)} Dwell_s \times \left(\sum_{p \in EP(s)} \sum_{p' \in EP(s+1)} FLOW_{gnp, dmp, s, p, p'} \right) = Njobs_{gnp, dmp, g} \quad \forall g, gnp, dmp,$$

where $Dwell_s$ is the number of years officers spend in stage s ; $S(g)$ is the set of stages s that fall within grade g ; $EP(s)$ is the set of entry profiles p possible for stage s ; and $Njobs_{gnp, dmp, g}$ is the number of jobs with gain pattern gnp and demand pattern dmp at grade g that must be filled or allocated.

⁷ The model could be adapted so that other officers could also fill jobs outside their own grades.

⁸ The Cplex optimization software is available with GAMS and is documented within the GAMS software.

The second constraint simply applies the overall retention and promotion patterns to each group of officers, ensuring that the same proportions of the cohort's officers continue into the next career stage regardless of the types of experience they have accumulated⁹:

$$\begin{aligned}
 R_{s-1} &\times \left(\sum_{(gnp, dmp) \in GD(s-1)} \sum_{p' \in EP(s-1)} FLOW_{gnp, dmp, s-1, p', p} \right) \\
 &= \sum_{(gnp, dmp) \in GD(s)} \sum_{p' \in EP(s+1)} FLOW_{gnp, dmp, s, p, p'} \forall s, p,
 \end{aligned}$$

where the retention rate, R_{s-1} , is the proportion of officers entering stage $s-1$ who continue into stage s and where $GD(s)$ is the set of pairs of gain patterns gnp and demand patterns dmp represented by jobs that may be filled by officers in career stage s . Note that the flows on the left-hand side **end** with background profile p and those on the right-hand side **begin** with background profile p .

The optimization maximizes the fulfillment of jobs' demands for backgrounds:

$$\begin{aligned}
 QUALSCORE &= \sum_s \sum_{(gnp, dmp) \in GD(s)} \sum_{e \in DM(dmp)} \sum_{\substack{p \in EP(s) \\ p' \in EP(s+1)}} Demand_{dmp, e} \\
 &\times Dwell_s \times FLOW_{gnp, dmp, s, p, p'},
 \end{aligned}$$

where $e \in \{msl, spc, eith, acq, rqt, plpr, ospt, tldr, stf, jstf, ostf, cmd\}$, the set of experience categories (the columns in Table 5.3), and $DM(dmp)$ is the set of positive demands in demand pattern dmp , and $Demand_{dmp, e} = 3, 2, 1$, or 0 if experience category e is rated as critical, important, useful, or irrelevant, respectively, in the demand pattern

⁹ The model can be reconfigured to relax these constraints. We incorporate them initially because, if the Air Force were to guide flows based on patterns developed using such a model, it may be thought unfair if officers progressing through some sequences of jobs enjoyed higher retention and/or promotion rates than others.

dmp. Given the demand patterns shown in Appendix E, the *QUALSCORE* value would be 7,089 if every O-4 to O-6 job could be filled by an officer who brought all experience categories needed for the job.

From the *FLOW* variables, various summary output measures can be calculated. One valuable summary measure is $INV_{p,s}$, the inventory of officers who enter career stage s with experience profile p :

$$INV_{p,s} = Dwell_s \times \sum_{(gnp,dmp) \in GD(s)} \sum_{p' \in EP(s+1)} FLOW_{gnp,dmp,s,p,p'},$$

which can be compared readily with the experience profiles observed in officers at different points in their real-world careers.

Readers familiar with modeling methods will recognize these relationships as a Markov model appropriate for linear optimization.¹⁰

Outputs

The structure of the model as it follows the flow of officers through successive career stages and grades allows generation of a number of

¹⁰ Markov models have “memoryless state spaces.” Here, the state space contains the sets of experience profiles, p , attainable at each stage. The next stage of development (i.e., an officer’s next assignment) depends on the profile attained, but not on which of many possible ways the officer could have developed that profile through the stages, s , already completed. Linear optimization methods maximize or minimize linear functions (here, *QUALSCORE*) of decision variables (here, the variables $FLOW_{gnp,dmp,s,p,p'}$) while holding other linear functions of the decision variables either above, below, or equal to specified values (here, filling the designated sets of jobs and consistently following the overall retention and promotion pattern). All told, the linear optimization problem has 1,399,132 variables (counting both the *FLOW* and *INV* variables) and 32,510 constraints. These numbers are much smaller than straightforward combinatorics suggest because the combinations of types of experience that can be accumulated from the actual jobs are limited, as Table 5.5 shows, and because each combination of incoming profile, p , and gain pattern, gnp , leads to just one exit profile, p' , an entry profile for the next career stage. The number of variables cannot be calculated using a closed-form expression, but GAMS calculates the count as it processes the job information before beginning its optimization step. See Hillier and Lieberman (2001), for example, for more about Markov models and linear optimization.

practical summary results that can be compared to the status of the existing force or across alternative optimization goals. Some of the summary measures include the following:

- the numbers (or percentages, if preferred) of officers possessing each category of backgrounds by career stage or for the force as a whole
- the numbers of officers with targeted background combinations at certain stages in their careers; for example,
 - missile and acquisition or space and acquisition experience by the end of a specified number of “tours”
 - operations officer or small-unit command experience before promotion to O-5
- the numbers of officers gaining one or more specific new types of experience at each career stage; for example, first experience in a missile job as a captain
- background goals that cannot be met; for example, how many (if any) of the jobs in joint staffs (Unified Command, OSD, or OJCS) for which plans and programs experience is critical must accept officers lacking that experience¹¹
- number of officers qualified for specific job groups; for example, how many majors would, upon promotion to lieutenant colonel, have all the types of experience regarded as critical or important for missile squadron commander jobs, indicating selectivity potential.

Model Uses and Limitations

We designed the model to optimize the preparation of 13S officers to meet the needs of current or future 13S jobs and to assess the implications for career development, utilization, and force composition of

¹¹ Such shortfalls may point out needs for specific education and training to help compensate for lack of the desired work experience.

changes in career structures, policies, and priorities. For example, we can use it to

- encourage depth over breadth, or vice versa
- encourage acquiring specified types of experience (for example, following “career ladders” that combine acquisition and either space or missile operations early in one’s career)
- increase the numbers of officers qualified for different kinds of jobs
- avoid “specialization” in nonoperational activities
- ensure that officers hold at least two jobs of a specified type, or even consecutive jobs, within a given portion of their careers

In Chapter Six, we will illustrate the potential implications of pursuing such goals.

In using and interpreting results from the model, readers should also keep in mind its limitations. Because of its simplified reflection of complex behaviors and requirements, the model’s results can provide insights into broad policy trade-offs and provide broad guidance for career development. The model has the advantage of facing a stable set of jobs whose demands and preferences for experience are explicit, and it assumes that the broad framework governing career progress is stable over time. In contrast, the Air Force’s real personnel system faces an evolving set of jobs with demands and preferences for types of experience that are often less definitive, while neither retention and promotion behavior, retention rates, nor career-progression patterns are fully stable. On the other hand, in the Air Force’s personnel system, the lengths of officer assignments are flexible; the sequences and patterns of assignments can change; and, depending on their specific accumulated backgrounds, officers can be retained or promoted at differential rates—options that this version of the model cannot exploit. Readers should also keep in mind that it usually takes 22 years or more for an officer to reach grade O-6, so changes in policy for force development may take several years to have much effect.

Improving Officer Development and Utilization

In this chapter, we use the optimization model described in Chapter Five to assess the feasibility and effects on force composition of alternative objectives for developing the 13S workforce. Although illustrative, the options considered suggest changes that could improve the development and utilization of 13S officers and demonstrate that there is considerable room for management discretion and policy guidance to shape the career field in preferred ways. We recommend that the Air Force use this mechanism to refine, and possibly consider other options to guide, its decisions regarding the future development and career paths that officers should follow.

Below, we first establish that the sizable experience gaps we identified in Chapter Four persist, even under the aggregated categorization of types of experience used in the optimization model. Then, we describe five optimization cases and compare their results with the development and utilization patterns observed in 2001.

Gaps Remain, Even Though Types of Experience Are Aggregated

Chapter Four found significant gaps in 2001 between the experience a given job needs and the experience a typical incumbent has. Even though the force's aggregate experience largely met the needs of the jobs at each grade (i.e., counting all officers and all jobs), we saw larger gaps when we compared the demands for and the supplies of

combinations of experience (still considering all officers within a grade) and very large gaps when we compared the needs of individual jobs with the experience of their incumbents. Table 6.1 shows that person-to-job gaps are large even when the experience categories described in Chapter Five are aggregated, allowing some specific types of experience to substitute for others. It indicates, for instance, that 21 percent of the jobs needing experience in space operations, 23 percent of the jobs needing experience in MAJCOM or Air Staff jobs, and 43 percent the jobs needing experience in technical leadership (a prior job at the group or wing level with the instructor or the standardization and evaluation AFSC prefix) lacked an incumbent with these types of experience.

Moreover, if we evaluate the development and utilization of 2001’s 13S officers in terms of their jobs’ “demand points,” in terms of these 12 consolidated categories, 2001’s incumbents achieved about 63 percent of the perfect score. In contrast, each optimization solution’s development and utilization patterns would achieve more

Table 6.1
Jobs for Which Prior Experience Was Needed but Lacking, by
Category of Experience and Grade, 2001 (percent)

Background	Grade			All
	O-4	O-5	O-6	
Missile	7	7		7
Space	15	27	39	21
Missile or space	2	4	25	4
Acquisition	62	55	52	58
Requirements	79	71	70	74
Plans, programs	67	65	24	61
Communications or intelligence	81	68	100	77
Group or wing and k or q	49	32	35	43
MAJCOM, Air Staff	34	17	9	23
Unified command, OJCS, OSD	59	51	35	53
Other organizations	64	63	54	63
Command	96	42	4	38

SOURCES: RAND survey of senior 13S core Air Force officers for jobs’ backgrounds and AFPC historical personnel data for officers’ backgrounds.

than 99 percent of the perfect score. Finally, while only 42 percent of 2001's incumbents *fully* met their jobs' needs for experience in these 12 categories, more than 96 percent would do so under the optimization solutions, as is further discussed below.

Five Optimization Cases

We outline the five combinations of policy objectives and requirements for development of the 13S workforce briefly below. Three cases use different objectives and identify officer flows based on the jobs and their needs for experience as they stand now¹; one case reflects a potential policy change that would require future commanders to have experience both in acquisition and on a joint staff; and one case reflects potential future growth in operational missions and shifts of some support activities to civilians.²

Case 1: Optimization

In this initial case, we simply maximized the fulfillment of job needs for experience—the *QUALSCORE* expression in Chapter Five. The optimized flows would develop and utilize 13S officers in a way that would score 7,050 (99.5 percent of the perfect 7,089 score if all officers entering jobs above O-3 had experience in every category rated as needed for their particular jobs).³

¹ We use *now* to indicate the jobs authorized for or filled by 13S officers in 2001, the jobs' needs for experience that senior officers identified during 2002, and the backgrounds accumulated by the 13S officer force up through the end of 2001.

² While each optimization solution is distinct, none is unique. That is, with the same jobs, requirements, and constraints, many alternative development and utilization patterns (sets of officer flows) could fare just as well with respect to the objective function used in that particular optimization. Thus, it is usually possible to provide further guidance to the optimization, causing it to seek or avoid patterns that may be more or less desirable for other reasons, without diminishing the fulfillment of top-level objectives.

³ In all five cases, a subordinate objective minimizes the number of officers who would enter their fifth jobs with either of two combinations of background that were regarded as undesirable: (a) experience in both missile and space operations or (b) experience in neither missile nor space operations.

Case 2: Optimization, Ladders, and Depth

The Air Force's emerging strategic plan for space professionals then identified missile, space, and acquisition ladders or career tracks intended to give young officers both operational and acquisition experience during their first three tours. The Rumsfeld Space Commission complained that many leaders in the career field had limited experience in the operations and activities they oversaw. To address these concerns, this case introduces two new terms to the optimization's objective function. First, while keeping the primary goal of meeting the jobs' demands for experience, we also identified combinations of experience desired when officers enter their fifth jobs, after 8.4 years of service, or roughly when they have completed three "tours." The desired types of experience include either acquisition and missiles or acquisition and space. We asked the model to maximize an expression that counts the number of officers with the targeted combinations of experience just before entering their fifth jobs. Second, to encourage the development of depth overall (not just early in the career), we asked the model to maximize another expression that reflects a weighted sum of the numbers of officers who have accumulated different numbers of experience categories, and the fewer categories the better—e.g., it is better to have experience in either missile operations or space operations but not both, unless it is necessary for meeting the demands of some jobs for both.

Because these additional goals are subordinate to the primary goal, the model still identified career flows that would score 7,050, or 99.5 percent of a perfect 7,089, with respect to the jobs' demands for experience. Moreover, some 42 percent of the officers would bring both operational and acquisition experience to their fifth jobs, compared with 30 percent in Case 1. Overall, officers in this case would have about 14 percent fewer of the 12 experience categories than in Case 1.

Case 2's results probably warrant the greatest interest of all the options presented in this report, because the Air Force space commu-

nity emphasizes career ladders or tracks and because the Rumsfeld Space Commission was concerned about lack of depth.⁴

Case 3: Optimization, Ladders, and *Breadth*

To assess whether there is enough flexibility to give officers wider backgrounds, we altered Case 2's objective function to favor backgrounds containing more rather than fewer categories of experience—e.g., it is better to have both missile and space experience than to have only one or the other. Again, we kept this objective subordinate to maximizing fulfillment of the jobs' needs for experience and giving as many officers as possible experience in either acquisition and missiles or acquisition and space by the time they begin their fifth jobs. The resulting development and utilization patterns would still achieve 99.5 percent of the perfect demand score, and 42 percent of those entering their fifth jobs still would have both operational and acquisition experience. Overall, officers would have about 27 percent more of the 12 experience categories than in Case 2, and about 9 percent more than in Case 1.

Case 4: Further Integration of Warfighting and Acquisition

This option is consistent with the Rumsfeld Space Commission's recommendations that the same people develop, acquire, and employ space systems. We altered the demand data so that both acquisition and joint staff experience are rated at least as important for all command jobs.⁵ This increases one or both ratings for 199 jobs: 48 of 50

⁴ Appendix F shows one summary outcome of the optimization model for Case 2, the experience officers would accumulate by different points in their careers. Many other summaries can also be derived from the underlying flow variables, for all five cases.

⁵ The commission's intent could be served with greater fidelity if we adopted experience categories that distinguished numbered air forces from "other staff" and that excluded OSD from "joint staff" jobs, thus establishing two job groups that concentrate on warfighting and integration of space and missile operations with other Air Force operations and with joint and allied operations. Even so, Case 4 illustrates how the optimization's input data can be changed directly to explore policy options. Alternatively, we could have changed the objective function to favor profiles including both types of experience, regardless of specific jobs, in a manner akin to Cases 2 and 3. Case 4 is more directed and specific than that, and it

O-6 jobs, 109 of 113 O-5 jobs, and all 42 O-4 jobs.⁶ It also raises the perfect demand score by 10 percent, to 7,776, reflecting increases in the potential contributions of acquisition and joint staff experience by 55 percent and 71 percent, respectively. Like Case 2, this case aims to maximize the fulfillment of demands for experience, the number of officers entering their fifth jobs with one of the ladder or track backgrounds, and the depth of experience across the force as a whole. The optimization still finds flows that would achieve 99.4 percent of the perfect demand score; all the additional demand for acquisition and joint staffs experience could be fulfilled. But the elevated requirements would diminish the number of young officers with a targeted ladder or track background and diminish the force's depth in some categories of experience (see the next section).

Case 5: Weaponization of Space and Civilianization of Some Support Activities

This option illustrates potential future changes in the number and mix of jobs, reflecting the possibility of future weaponization of space platforms for either defensive or offensive operations while shifting some support jobs (e.g., in education and training or in planning and programming) to civilians, either government employees or contractors.⁷ To demonstrate this prospect, we arbitrarily increased the numbers of jobs that give experience in space operations from 720 to 1,152 (60 percent), preserving the mix of backgrounds identified as needed for such jobs in 2001. Among the jobs that do not give experience in space operations, we increased the number that demand experience in space operations from 457 to 640 (40 percent); decreased the noncommand jobs that do not demand experience in space operations from 854 to 789 (10 percent); decreased the non-

parallels the Air Force's potential use of altered guidance to command boards that would induce officers to build experience in both categories to be selected for command jobs.

⁶ Jobs that give command experience are distinguished at O-4 by having AFSC prefix C or B.

⁷ Shifting some of these kinds of jobs to enlisted personnel would allow the same changes as civilianization in the development and utilization of 13S officers.

command jobs at MAJCOMs, the Air Staff, or “other staffs” that give either plans and programs experience or no functional experience (i.e., neither acquisition, requirements, plans and programs, nor communications and intelligence) from 600 to 570 (5 percent); and left the remaining 713 jobs unchanged. Overall, the number of jobs would rise from 3,342 to 3,841 (15 percent), and the perfect demand score would rise from 7,089 to 8,990 (27 percent).⁸ The optimization still finds development and utilization patterns that would achieve 99.2 percent of the total perfect score. Some 38 percent of the officers would have both operational and acquisition experience when they began their fifth jobs, and the average number of experience categories across the whole force would be 9 percent greater than in Case 2.

Effects on Workforce Development

Comparing Aggregate Experience Growth

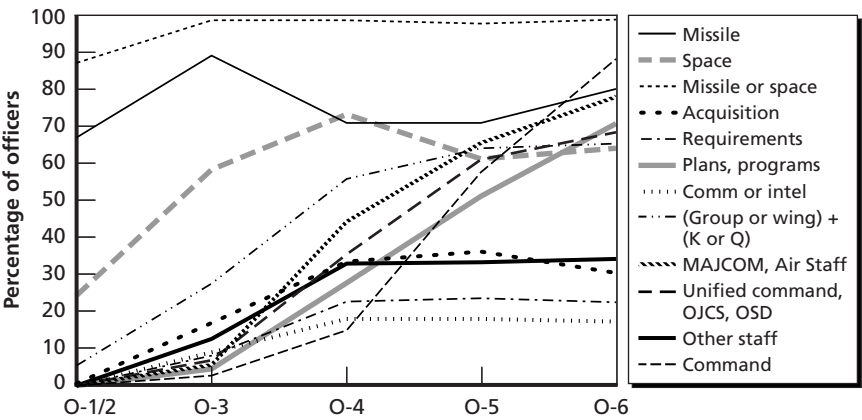
Figures 6.1–6.6 show how the shares of officers with each of the 12 categories of experience would grow in each case,⁹ along with the shares observed in 2001’s officers.¹⁰ Because the optimized results reflect development and utilization patterns applied consistently to successive identical entry cohorts, the shares of officers with each experience would never decrease as the cohorts progress. Occasional decreases in the display for 2001’s force (specifically, more captains than majors had missile experience; more majors than lieutenant colonels had space experience; and more lieutenant colonels than

⁸ These changes would also alter the distribution of jobs across the grades. We adjusted the retention and promotion rates correspondingly (increasing them slightly in stages s1 through s6 and decreasing them slightly in stages s7 through s12) to keep the officer inventory’s overall grade mix in line with the job counts.

⁹ The optimization’s solutions tell the numbers of officers who would have each background at each of the 13 career stages considered in the model, but displays of averages in these figures across all stages within the grades seem adequate for purposes of comparing the cases.

¹⁰ The corresponding data are tabulated in Appendix G.

Figure 6.1
Differential Growth in Categories of Experience, 2001 Inventory

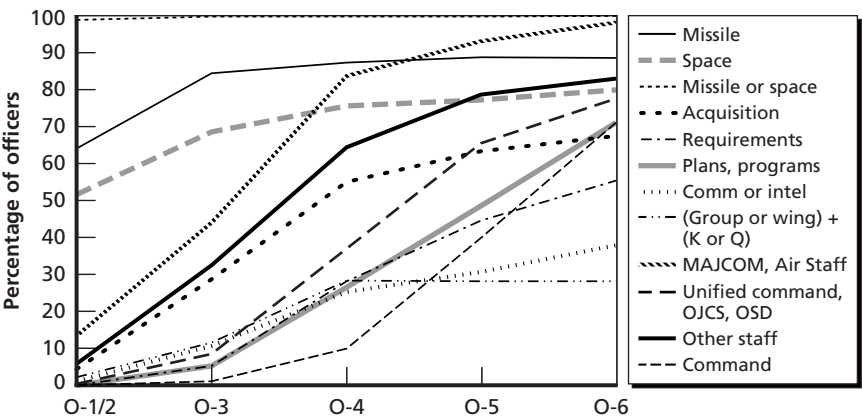


SOURCE: Appendix G.

NOTE: This graph counts experiences from prior *and* current jobs.

RAND MG382-6.1

Figure 6.2
Differential Growth in Categories of Experience, Case 1: Initial Optimization

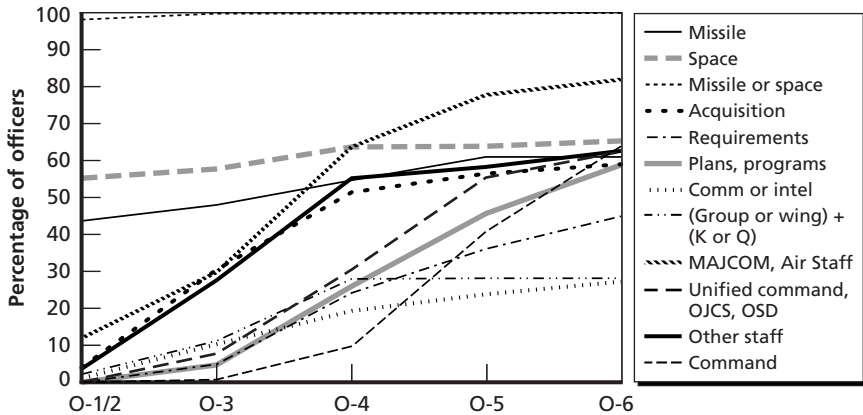


SOURCE: Appendix G.

NOTE: This graph counts experiences from prior *and* current jobs.

RAND MG382-6.2

Figure 6.3
Differential Growth in Categories of Experience, Case 2: Optimization, Ladders, and *Depth*

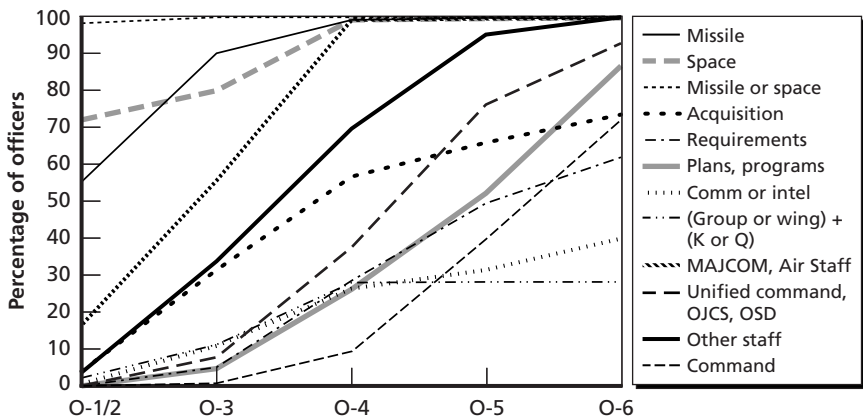


SOURCE: Appendix G.

NOTE: This graph counts experiences from prior *and* current jobs.

RAND MG382-6.3

Figure 6.4
Differential Growth in Categories of Experience, Case 3: Optimization, Ladders, and *Breadth*

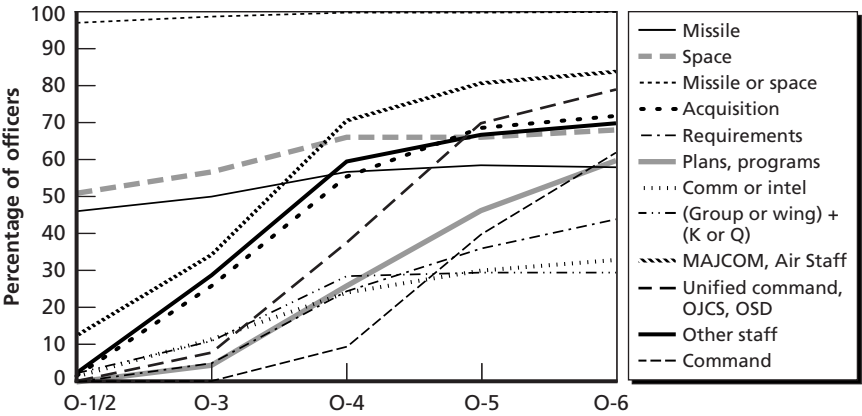


SOURCE: Appendix G.

NOTE: This graph counts experiences from prior *and* current jobs.

RAND MG382-6.4

Figure 6.5
Differential Growth in Categories of Experience, Case 4: Integration of Warfighting and Acquisition—Future Option 1

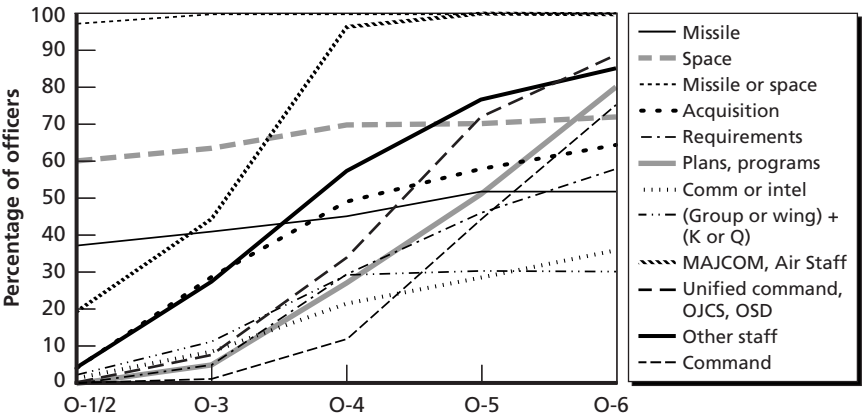


SOURCE: Appendix G.

NOTE: This graph counts experiences from prior *and* current jobs.

RAND MG382-6.5

Figure 6.6
Differential Growth in Categories of Experience, Case 5: Weaponization of Space and Civilianization of Some Support—Future Option 2



SOURCE: Appendix G.

NOTE: This graph counts experiences from prior *and* current jobs.

RAND MG382-6.6

colonels had acquisition experience) result from differences over time in the size, the retention and promotion rates, and the development of the many cohorts that formed today's (2001) 13S force.

Case 1 (see Figure 6.2), which is only trying to meet job requirements fully, would create a workforce somewhat more broadly experienced than 2001's: Majors would average 6.2 categories of experience; lieutenant colonels would average 7.6; and colonels would average 8.6, compared with corresponding averages of 5.7, 6.6, and 7.3 in 2001. Notably, more officers above O-3 would have experience in missile operations, space operations, acquisition, requirements, communications and intelligence, MAJCOM and/or Air Staff, and other staff; about the same shares would have experience in plans and programs and on joint staffs; and fewer would have experience as technical leaders and in command jobs.

The optimization works to lower the lines in Figure 6.3 (Case 2, optimization, ladders, depth) and raise them in Figure 6.4 (Case 3, optimization, ladders, breadth), so Case 1's growth for each experience category generally falls between those for Case 2 and Case 3. In Case 2, majors, lieutenant colonels, and colonels would average 5.3, 6.5, and 7.2 experience categories, respectively, compared with 6.8, 8.4, and 9.6 in Case 3. This suggests that the career field can accommodate the development and utilization both of rather specialized and of more broadly experienced officers, depending on the Air Force's and/or the officers' preferences. The fewer categories of experience an officer accumulates, of course, the more time he or she spends in each category—i.e., the greater the officer's depth in each category. Table 6.2 shows how much more experienced officers would be under Case 2's development and utilization patterns than under Case 3's. For example, new lieutenant colonels (O-5s) with previous experience in space operations would have 55 percent more space experience in Case 2 than in Case 3. And new colonels would average 24 percent more experience in plans and programs. Officers who followed Case 2's career paths would tend to have greater depth than if they followed Case 3's paths in most of the experience categories in which they had any experience at all.

Table 6.2

Percentage More Time: Case 2 (Optimization, Ladders, *Depth*) Officers Than Case 3 (Optimization, Ladders, *Breadth*) Officers Spend Acquiring Each Category of Experience, by Grade

Backgrounds	Grade			All
	O-4	O-5	O-6	
Missile	81	81	63	64
Space	56	55	54	44
Missile or space	0	0	0	0
Acquisition	4	15	18	10
Requirements	0	20	40	25
Plans, programs	0	0	24	14
Communications or intelligence	14	29	33	29
Group or wing and k or q	0	0	0	0
MAJCOM, Air Staff	60	39	28	52
Unified command, OJCS, OSD	0	27	36	29
Other organizations	3	33	63	35
Command	0	0	0	4

SOURCE: Appendix G.

NOTE: The last column includes officers from O-1 through O-6.

As expected, Case 4 (further integration of acquisition and war-fighting, Figure 6.5) would bring some noteworthy increases in the numbers of officers with experience in acquisition and on joint staffs: 56 percent of O-4s, 69 percent of O-5s, and 72 percent of O-6s would have acquisition experience, compared with 51 percent, 56 percent, and 59 percent, respectively, under Case 2. Correspondingly, 38 percent, 70 percent, and 79 percent would have joint staff experience, compared with 31 percent, 55 percent, and 63 percent under Case 2. As noted at the outset, however, these increases would dictate that fewer officers have both operational and acquisition experience by the time they entered their fifth jobs (i.e., fewer would qualify as being on one of the three career ladders), and the overall depth of experience would fall (e.g., O-4s, O-5s, and O-6s would have about 0.3, 0.4, and 0.4 more categories of experience under Case 4 than under Case 2).

Case 5 (weaponization of space and civilianization of some support activities, Figure 6.6) would bring large increases in the shares of officers with MAJCOM and/or Air Staff experience: 61 percent over-

all, compared with 42 percent in Case 2. Many more colonels would have plans and programs, joint staff, and other staff experience—81 percent, 89 percent, and 86 percent, respectively, compared with 59 percent, 63 percent, and 63 percent in Case 2. Notably, more at the higher grades would also have experience in requirements and in communications and intelligence. While almost the same numbers of officers would have missile experience as in Case 2, the shares would be lower because the total force would be larger. (The overall share with missile experience would be 43 percent in Case 5, compared with 51 percent in Case 2.) Apparently, the jobs added in Case 5 tend to demand more experience than those deleted, because the numbers of types of experience per officer would rise by 8 percent, 13 percent, and 18 percent for O-4s, O-5s, and O-6s, respectively, thereby reducing the average depth in each category somewhat relative to Case 2.

Comparisons with Respect to Combinations of Experience

Because the optimized flows would yield so few experience shortages, they would substantially reduce gaps between the background combinations demanded by each grade's jobs and the officers in grade who would have those combinations (disregarding for the moment whether the officers are actually assigned to the jobs that need their backgrounds). For example, in 2001, 31 fewer officers had missile operations, acquisition, plans and programs, technical leader, MAJCOM staff or Air Staff, joint staff, and other staff experience than there were jobs for which all these types of experience were regarded as critical or important. In Case 1, that particular shortfall would decrease to 15 (all at O-4). Overall, in 2001, some 55 jobs above O-3 required 17 combinations of experience that were regarded as critical or important and that were not fully present among the officers at the corresponding grades; the corresponding figures in Case 1 would be 35 jobs and 10 combinations.

Instead of delineating the few shortfalls that would remain, it seems more instructive to consider some broad differences in the background combinations that the 13S force would exhibit in the different cases. Figures 6.7 through 6.12 show the percentages of offi-

cers in each grade who would have each of the eight possible combinations of missile, space, and acquisition experience.¹¹ Note that there is again an irregular pattern in the 2001 workforce, reflecting changes over time in the force structure and in career guidance. Many officers had experience in both missile and space operations but no experience in acquisition, and few except lieutenants had concentrated in either missile or space operations to the exclusion of the other and of acquisition.

Because Case 1 is something of a compromise between Cases 2 and 3,¹² let us specifically address Cases 2 and 3. Case 2's emphasis on depth would allow about two out of three officers to maintain concentration on either missile or space operations and spend no time in acquisition—including 47 percent of majors, 40 percent of lieutenant colonels, and even 36 percent of colonels.¹³ In contrast, Case 3's emphasis on breadth would leave no officers above captain with that level of operational concentration. It would rush people through as many types of experience as possible as soon as possible, as long as that would not reduce the fulfillment of demands for experience or fall below the maximum-possible 42-percent share of the force with both operational and acquisition experience by the time they entered their fifth jobs. In this case, some 73 percent of colonels would have experience in acquisition and in both missile and space operations, compared with only 22 percent in Case 2.

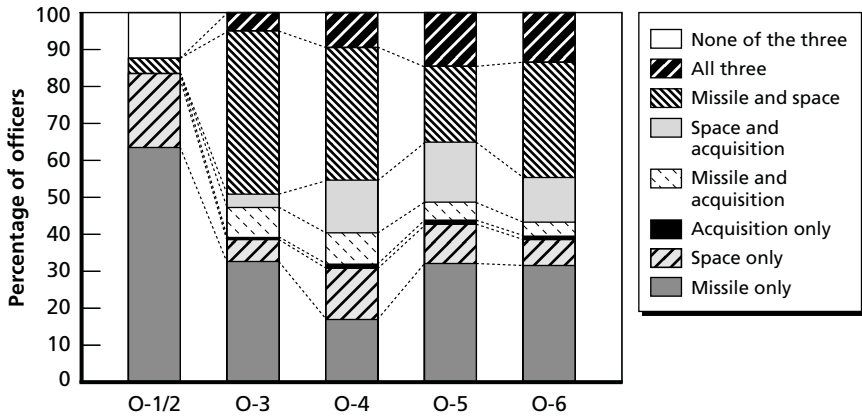
¹¹ The corresponding data are tabulated in Appendix G.

¹² Unlike Cases 2 and 3, Case 1 sought only to fill jobs with appropriately qualified officers and did not particularly pursue either depth or breadth. Because Case 2's and Case 3's results differ so markedly but are equal to Case 1's in maximizing fulfillment of jobs' demands for experience, we can see that many, many other intermediate flow patterns are possible.

¹³ Many of these officers would still spend time in staff jobs, of course; they could not spend their entire careers in operational units.

Figure 6.7

Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: 2001 Inventory

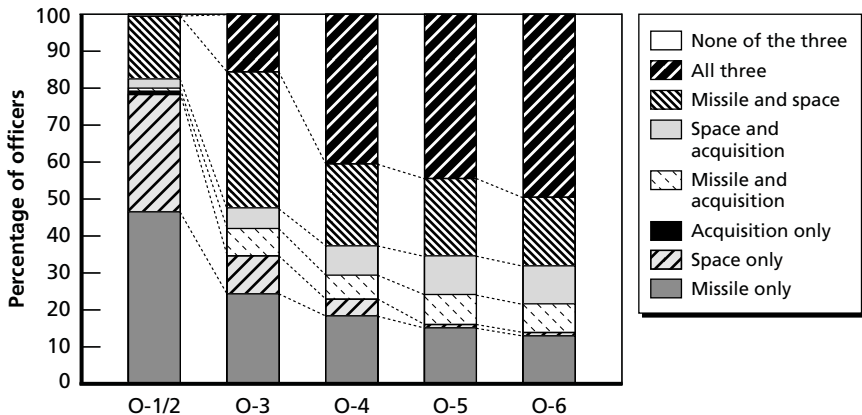


SOURCE: Appendix G.

RAND MG382-6.7

Figure 6.8

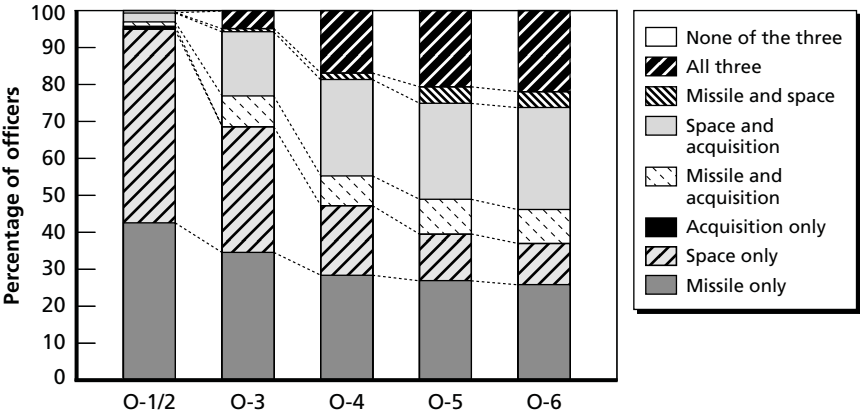
Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: Case 1



SOURCE: Appendix G.

RAND MG382-6.8

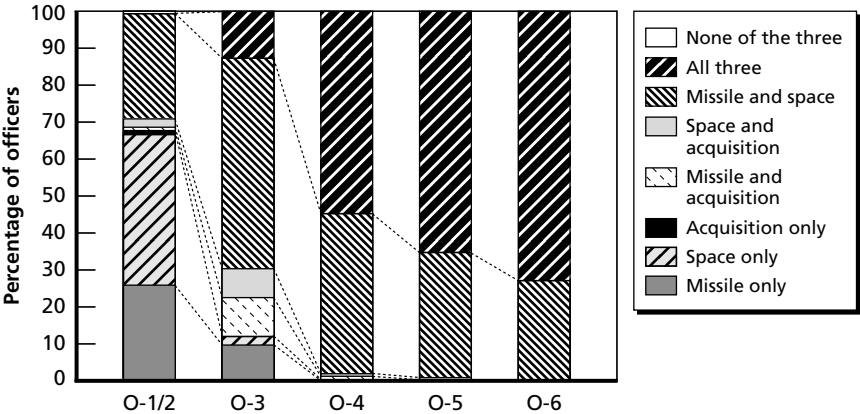
Figure 6.9
Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: Case 2



SOURCE: Appendix G.

RAND MG382-6.9

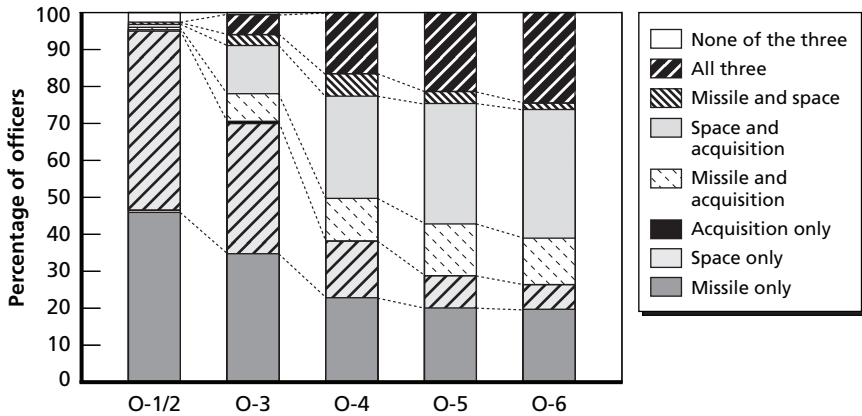
Figure 6.10
Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: Case 3



SOURCE: Appendix G.

RAND MG382-6.10

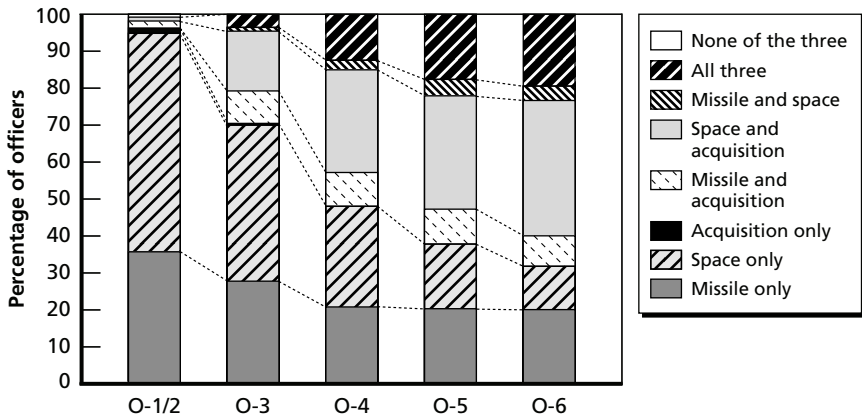
Figure 6.11
Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: Case 4



SOURCE: Appendix G.

RAND MG382-6.11

Figure 6.12
Differences in the Shares of Officers with Combinations of Missile, Space, and Acquisition Experience: Case 5



SOURCE: Appendix G.

RAND MG382-6.12

Because the optimizations in Cases 4 and 5 used the same objectives in the same priority order as Case 2, their distributions of officers by combination of types of experience are much like Case 2's. For the eight combinations of experience considered in Figures 6.7 through 6.12, Cases 4 and 5 would have relatively fewer officers than Case 2 with experience only in missile operations (19 percent and 20 percent of the colonels, for example, compared with Case 2's 25 percent). Case 4 would have somewhat fewer and Case 5 somewhat more officers with experience only in space operations (e.g., 9 percent of Case 4's lieutenant colonels and 17 percent of Case 5's, compared with 13 percent of Case 2's).

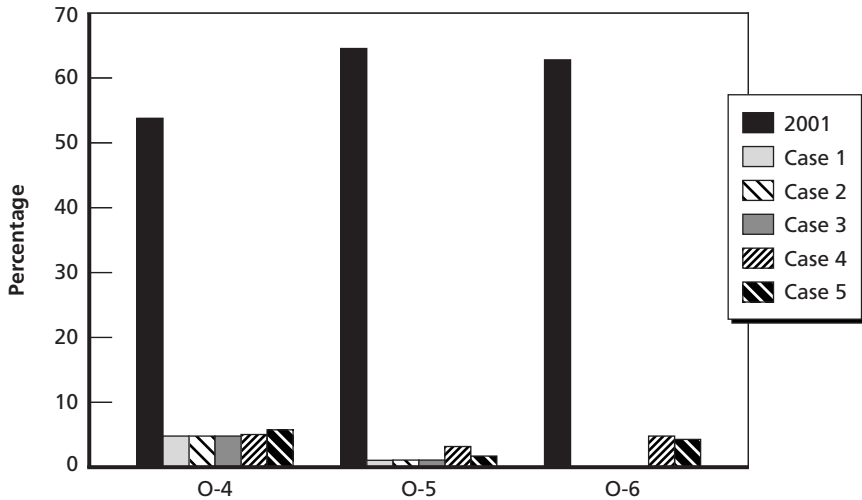
We could examine other experience combinations just as closely at any point or interval throughout 13S officer careers and alter the model's goals to seek or avoid those combinations, inducing the optimization to identify other development and utilization patterns that would have additional desirable properties.

Comparing Person-to-Job Matches

This is the crucial level for assessing flows because it tells whether officers are or would be developed with the appropriate experience *and* be assigned to jobs needing those types of experience. As discussed in detail in Chapter Four and again early in this chapter, consolidating specific types of experience into categories (thus allowing some specific types of experience to substitute for others) reveals discrepancies between the backgrounds the jobs needed and the backgrounds of the 2001 incumbents actually had when starting these jobs. Figure 6.13 shows how many of 2001's jobs at O-4, O-5, and O-6 (among the jobs needing experience) had an incumbent who lacked at least one needed type of experience when he or she took the job, compared with the numbers in the five optimization cases. Clearly, the optimized development and utilization patterns would provide fully qualified officers for many more jobs.

Moreover, in the optimized cases, incumbents would never lack more than one of the types of experience targeted for their jobs, while incumbents lacked as many as seven in 2001. When incumbents

Figure 6.13
Shares of Incumbents Lacking One or More Types of Prior Experience
Needed for Their Jobs



SOURCE: Appendix G.

NOTE: Includes only jobs that need one or more categories of prior experience.

RAND MG382-6.13

lacked at least one targeted experience category in 2001, they lacked an average of 52 percent of the types of experience targeted: 57 percent for those in O-4 jobs, 49 percent for those in O-5 jobs, and 40 percent for those in O-6 jobs. The corresponding averages in the optimized cases range from 15 percent to 17 percent overall: 16 percent to 18 percent for O-4 jobs, 10 percent to 17 percent for O-5 jobs, and always 0 percent for O-6 jobs. That is, not only would incumbents' experience seldom fall short of what their jobs need, but the shortfalls would be less extensive when they did occur. The jobs whose demands the optimized flows could not fill completely tend to be very demanding, usually calling for 6 or more of the 12 experience categories. Perhaps the experience targets for many of these jobs have been set too high, as we noted earlier. If not, the Air Force probably should consider raising the jobs' authorized grades, giving officers more time to accumulate the necessary experience.

Table 6.3 shows how often each type of experience was or would be missing. For example, when 49 percent of the O-4 jobs that need experience as a technical leader (an instructor or standardization and evaluation assignment at group or wing level) had an incumbent who lacked that background in 2001, only 4 percent would lack that experience in Cases 1 through 3, only 5 percent in Case 4, and only 6 percent in Case 5. The optimized development and utilization patterns would eliminate most gaps between jobs' demands and incumbents' incoming experience, coming up a little short only for experience in planning and programming, as a technical leader, and in command.¹⁴ Both the real-world assignment system and the optimizations tend to do somewhat better in meeting demands for higher-grade jobs and for experience in operational missions. Commanders and supervisors may be more specific in spelling out the backgrounds needed for higher-grade jobs, providing better, more-complete guidance for identifying candidates for job openings and the need for operational mission experience probably is specified more often. Even so, it is noteworthy that so many jobs that need space experience and jobs that need either space or missile experience were filled in 2001 by officers who lacked such experience—e.g., 39 percent of the O-6 jobs that need space experience and 25 percent of those that need either space or missile experience. Such high numbers for O-6 jobs reinforce the Rumsfeld Space Commission's concern about inadequate experience among leaders in the career field.

The optimizations show that it is possible to fill those jobs with officers having the necessary operational mission experience.¹⁵

¹⁴ As we noted previously, the optimizations enjoy the advantage that the types of experience each job needs are spelled out consistently and relatively completely. It is unfair to expect real-world assignments to meet job demands for experience if the demands had not been made explicit. (On the other hand, our construction of "useful" demands as additional demands for the optimizations raises their goals even higher.)

¹⁵ It is possible, of course, that the Air Force deliberately uses such jobs to introduce officers from other career fields—e.g., pilots or C² specialists—to the space and missile area. To whatever extent that is the case, incumbents naturally would not have the targeted space and missile operational experience.

Table 6.3

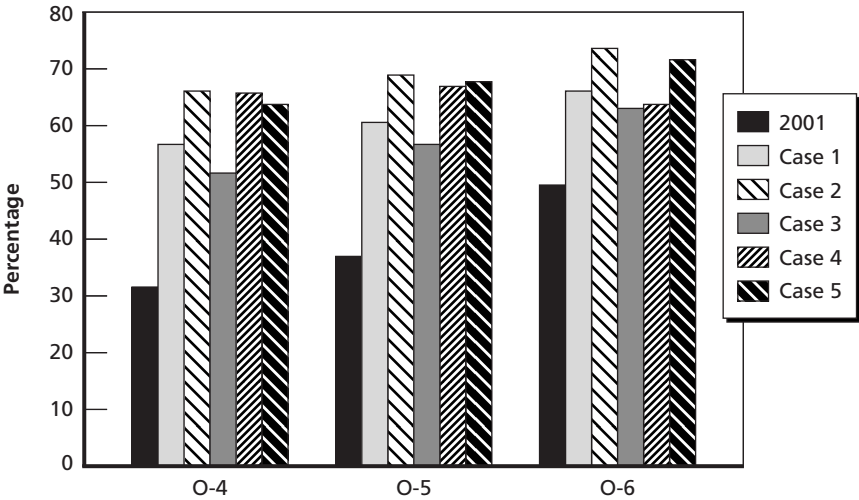
Percentage of Jobs Needing Each Experience with Incumbents Lacking That Experience, 2001

<div> <div>missile</div> <div>space</div> <div>missile or space</div> <div>acquisition</div> <div>requirements</div> <div>plans, programs</div> <div>comm or intel</div> <div>(group or wing) + (k or q)</div> <div>maicom, air staff</div> <div>unified cmd, ojs, osd</div> <div>other staff</div> <div>command</div> </div>											
Mission			Function				Organization				Cmd
msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jsjf	ostf	cmd
2001's officers											
O-4	7%	15%	2%	62%	79%	67%	81%	49%	34%	59%	96%
O-5	7%	27%	4%	55%	71%	65%	68%	32%	17%	51%	42%
O-6		39%	25%	52%	70%	24%	100%	35%	9%	35%	4%
Total	7%	21%	4%	58%	74%	61%	77%	43%	23%	53%	38%
Case 1: Optimization											
O-4						10%		4%			9%
O-5											2%
O-6											
Total						5%		3%			2%
Case 2: Optimization, ladders, depth											
O-4						10%		4%			9%
O-5											2%
O-6											
Total						5%		3%			2%
Case 3: Optimization, ladders, breadth											
O-4						10%		4%			9%
O-5											2%
O-6											
Total						5%		3%			2%
Case 4: Further integration of warfighting and acquisition (Future Option 1)											
O-4						11%		5%			10%
O-5						2%		1%			5%
O-6						7%		3%			8%
Total						7%		4%			6%
Case 5: Weaponization of space and civilianization of some support activities											
O-4						12%		6%			5%
O-5						1%		2%			2%
O-6						3%					7%
Total						7%		4%			3%

So far, our discussion of person-to-job matches has addressed the degree to which assigned officers meet their jobs' needs for experience. What about the degree to which their jobs make use of the officers' backgrounds? The more the types of experience officers have are needed, the more productive they may be than others, the more satisfied they may be with their jobs and careers, and the more likely they

will be to expect the Air Force to continue their deliberate development and utilization. Figure 6.14 shows the average utilization of officers' incoming experience in their current jobs. For example, in 2001 about 31 percent of the types of experience officers filling O-4 jobs brought were needed for their jobs, 37 percent for those in O-5 jobs, and 50 percent for those in O-6 jobs. Not surprisingly, the optimized flows would do markedly better in this regard, raising average utilizations to a low of 51 percent for O-4s in Case 3 and a high of 73 percent for O-6s in Case 2. Naturally, the utilizations would be lower for Case 3 because it gives officers as many categories of experience as possible, although it gives even higher priority to meeting the jobs' demands for experience and using the first four jobs for putting officers on either a missile, space, or acquisition career ladder.

Figure 6.14
Jobs' Utilization of Officers' Accumulated Experience



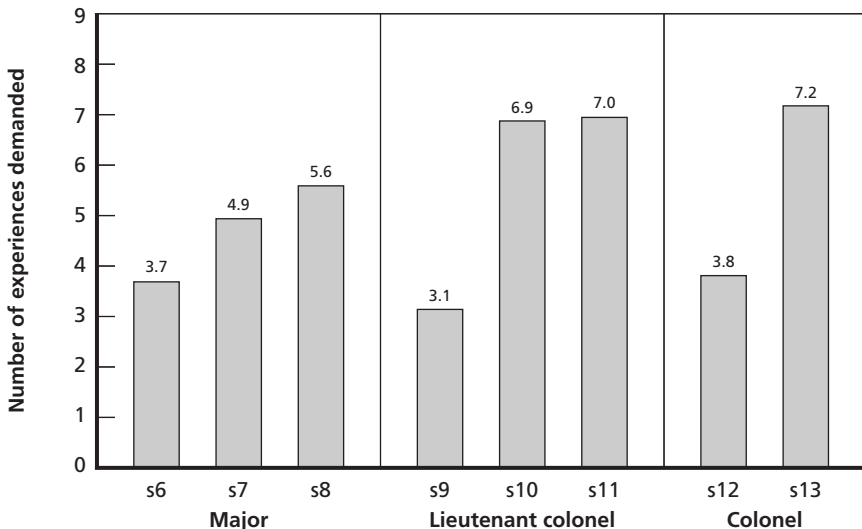
SOURCES: AFPC historical personnel data and Appendix G.

NOTE: Includes only jobs that need one or more categories of prior experience.

Conclusions

Cases 1 through 5 fare better with respect to so many measures than the officer inventory and assignments in 2001 because their optimizations can so deliberately *use* jobs to prepare officers for subsequent jobs. In the real world, this would necessitate raising the priority accorded to officer development in the assignment process, where it contends with an overriding need to simply *fill* jobs. To reach a better balance, the Air Force would need more careful and systematic delineations of the types of experience jobs need and the types of experience these jobs *contribute*. Figure 6.15 illustrates how Case 2's flows, for example, would tend to place the more-demanding jobs

Figure 6.15
More-Demanding Jobs Come Later in Each Grade (Case 2)

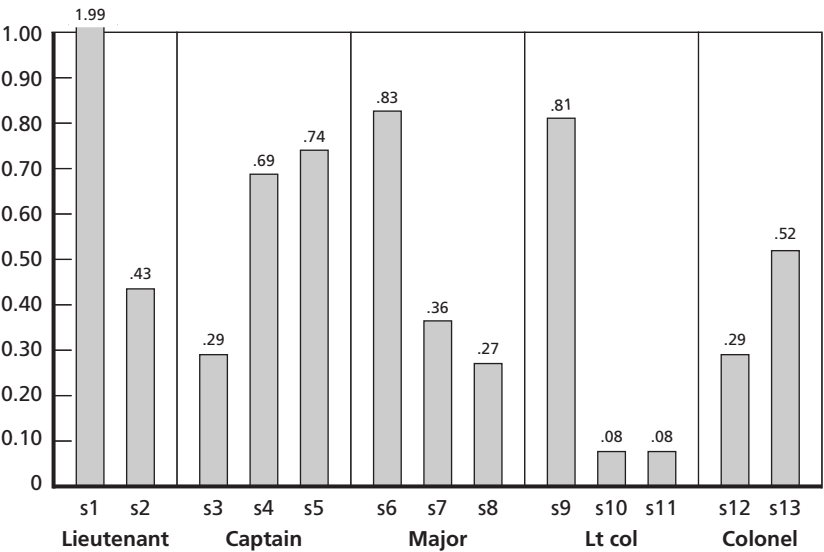


SOURCE: Appendix F.

RAND MG382-6.15

later in a grade, allowing more advance preparation.¹⁶ Figure 6.16 shows that more learning would occur (at least more new categories of experience would accrue, on average) during officers' first jobs as majors and lieutenant colonels than at any other career stage beyond the first.¹⁷ First-stage majors and lieutenant colonels would gain an average of 0.83 and 0.81 new experience categories, respectively. For

Figure 6.16
First Jobs at O-4 and O-5 Bring Many New Types of Experience (Case 2)



SOURCE: Appendix F.

RAND MG382-6.16

¹⁶ *More demanding* and *less demanding* here refer to the number of types of experience needed. More categories are more demanding, and fewer categories are less demanding. Jobs may be very challenging, of course, even if they call for only few categories of experience—as is the case for many jobs for operations officers and small-unit commanders, for example.

¹⁷ Almost all officers would have their first operational mission experience as entering lieutenants, when our categorization and scoring scheme gives them credit for two new types of experience: (1) whichever specific operational mission category they undertake and (2) the “either space or missile” category.

instance, some 83 percent of those whose first experience in requirements came as lieutenant colonels would encounter it at their first jobs, and 84 percent of those whose first command experience came as lieutenant colonels would be commanders during their first jobs in the grade.

Their ability to do better fundamentally at person-to-job matching lets the optimized development and utilization patterns do better in the aggregate and in fulfilling grades' needs for combinations of experience, addressed earlier.

Conclusions and Recommendations

In this final chapter, we summarize our key findings and propose ways to improve the development and utilization of space and missile officers. We also recommend next steps for AFSPC as the career-field manager for 13S officers, for the Air Force personnel community and other career-field managers to extend this approach and apply it elsewhere, and for ourselves or others to further develop the underlying analytic methods.

Conclusions

This work demonstrates that the education, training, and experience needs for 13S jobs can be systematically identified and prioritized (Chapter Two), that officers' experience can be discerned from historical personnel records (Chapter Three), and that gaps between jobs' needs and officers' experience can be delineated (Chapter Four). We have shown that the 13S career field is sustainable because a steady-state flow model can identify development and utilization patterns (flows and assignments) from lieutenant through colonel that would meet virtually all the needs for experience identified for jobs above O-3. That is, repeating the patterns year after year would grow and assign officers so that their accumulating repertoires of experience would match the needs of their successive jobs. This is due in part to our experts' judgments that either missile or space experience is adequate for performing most jobs above O-3.

Plenty of 13S officers apparently have technical degrees,¹ but jobs that require a technical degree are frequently not filled with an officer holding the appropriate technical degree. Promotion rates are about the same whether officers began their 13S careers in space or missile operations, but retention rates are somewhat higher for those who began with missiles. The time spent in space operations is relatively short for many officers. About a third of those with experience in satellite C² spent less than two years in such jobs, and from half to three-quarters of those with experience in space warning or surveillance operations spent less than two years.

In 2001, ample numbers of officers had experience in the various operational mission areas, as instructors, as commanders, and in current operations, logistics, and plans and programs, for example, but too few had experience as contingency and war planners and in safety, intelligence, acquisition, and numbered air forces. Combinations that were in greatest shortage usually included several kinds of experience, typically in current operations and one or more functional areas (typically acquisition, requirements, and/or T&E), NRO or SMC, MAJCOM and/or higher headquarters (Air Staff or OJCS and/or OSD), and technical education. It is very difficult for officers to accrue so many types of experience before becoming lieutenant colonels, so the Air Force should either consider shifting some O-4 jobs that demand so many prior types of experience to a higher grade or reevaluate the need for the targeted breadth of experience.

Gaps between jobs' needs for experience and officers' backgrounds were far greater at the individual person-and-job level, where they really count. In about 90 percent of the jobs above O-3 that needed an experienced officer, the incumbent in 2001 lacked one or more of the targeted types of experience. Missing most often (relative to the numbers of jobs that called for them) were experience as a weapons and tactics instructor (W prefix) and as a contingency and war planner (R prefix), in certain functional areas (political-military affairs, communications, intelligence, R&D, acquisition, require-

¹ Except at O-6, whose deficiency in engineering should disappear as younger cohorts move up.

ments, and T&E), and in certain organizations (AFTEC, DTRA, OJCS or OSD, and numbered air force). Operational experience in space or one of the specific space missions was frequently missing.

The data indicate that too many assignments may be made without enough regard for either the experience the job needs or the experience an officer needs to gain to be prepared for future jobs. Our optimizations concentrate on this fundamental level, seeking flows that would develop and utilize officers (via assignments) more deliberately, e.g., by using a grade's less demanding jobs to give officers experience they will need for more demanding jobs scheduled later. Of course, this necessitates delineating, in similar terms, the requirements consistently and explicitly and the contributions the jobs make to officers' experience portfolios.

If the approximately 3,300 jobs that existed for 13S officers in 2001 were to remain relatively unchanged, the Air Force could adopt one of the forces identified in Cases 1 through 3 of Chapter Six (or a combination of those forces, or still another sustainable force that could meet the same and perhaps additional objectives) as a target, then work to mold the force into that form over time. Individual members would help shape the force themselves if the Air Force revised its official guidance to describe in more detail the background combinations officers should have accumulated by specific points in their careers, appropriate sequences of jobs, and/or the backgrounds desired in candidates for different job groups.

Career ladders or tracks that would concentrate officers on either acquisition, missile operations, or space operations—as long as some acquisition experience is included—can be created in the occupation, but fewer than half the officers could be established on one of those tracks by the time they had completed three tours (approximated in the flow model by completion of four jobs after 8.4 years of service). The force can accommodate officers with relatively specialized or very broad backgrounds. The average length of experience in some categories can be up to 50 to 60 percent greater in a more-specialized force (one developed for depth) than in one developed for breadth, and roughly 15 to 45 percent greater than the force in 2001.

Our analytic framework can identify changes in officer development and utilization patterns that would meet important potential changes in future requirements—i.e., changes in jobs' demands (as in Case 4, Future Option 1, further integrating warfighting and acquisition), the job mix (as in Case 5, Future Option 2, weaponizing space and civilianizing some support activities, which would also change the force size), or both—and it can explore the effects of managing the force under different career-guidance policies.

It is worth noting that the optimized flows would develop far fewer experience profiles than existed in 2001 (about half as many). That is, more officers would follow fewer job sequences than in the past (reflected in the fact that many fewer experience profiles would be observed), making it easier to discern well-conceived career paths that would systematically accumulate experience valuable for subsequent jobs.

Recommended Next Steps

The discussion above outlines many potential changes in the way 13S officers are developed and assigned, but we also have recommendations for (1) developing better data and more-specific targets for 13S officers, along with similar results for additional space professionals; (2) adapting this approach for other occupations, including professional development across traditional career-field boundaries; and (3) extending and improving the analytic methods to enhance their applicability.

Refining the Results and Addressing the Needs for Additional Space Professionals

We believe that, by investing a little more energy in this approach, AFSPC could and should develop more-precise plans for the career field and more-definitive career guidance for space and missile officers and should then undertake similar analysis and planning for additional space professionals. Specific steps might include the following:

- Further review and refine the data already in hand describing the types of experience needed for 13S jobs above O-3. Even though three consolidated panels of colonels reviewed and revised different parts of the demand data we had initially obtained from numerous nearly independent experts, some inconsistencies and discrepancies remain.
- Identify the backgrounds needed for additional 13S jobs: those that 13S officers fill in other AFSCs—such as Planning and Programming (16R), Operations Officer (16G), International Political-Military Affairs (16P), Instructor (81T), Academic Program Manager (82A), Protocol Officer (88P), and Executive Officer (97E)—and company-grade 13S jobs.²
- Carefully examine the results from our optimization cases and identify changes and preferences that would lead to still better and perhaps still less diverse development and utilization patterns.
- Once satisfactory flows or a range of flows have been identified, adopt specific aspects of the development and utilization patterns and the associated inventories as targets for the development and assignment teams that manage 13S officers' assignments. Initially, the teams could work to bring the force into alignment with broad inventory targets (the numbers of officers who should have specific experience profiles at each career stage). Later, targets could be established for how many officers with each given combination of experience should next move to

² We suggest that AFSPC and AFPC consider using a standardized form (akin to one we used for collecting demand data for this study) for all requisitions for 13S officers. Over time, commanders and supervisors would create and maintain a database about the positions for 13S officers, and mechanisms could be established to encourage consistency in their designation of candidates' qualifications—e.g., limiting the numbers of types of experience that could be listed at each level of priority for each job, with higher limits for higher-graded jobs, or limiting the qualifications that could be levied across sets of jobs under the requestor's purview. As with the demand data we obtained, the entire demand database could be reviewed periodically and systematically to ensure that demands are stated realistically and appropriately across organizations and grades. It should even be possible to make the database available to those submitting the requisitions, so that, in most cases, they could simply confirm or revise prescriptions already specified and could compare the demands specified for jobs in their units with those for jobs in other organizations.

several job groups at different points in their careers. Iteratively guiding the optimization model would help make both explicit in the solutions developed.

- Publish more-specific career guidance for the career field. For example, it can be made clear that, even though there are multitudes of sequences one can follow through a 13S career, most officers should aim to accumulate one of relatively few combinations of experience by different points in their careers—e.g., X percent should have had experience in missile operations, acquisition, plans and programs, and the Air Staff by the time they are promoted to lieutenant colonel, and Y percent should have had experience in satellite C², current operations, a numbered air force, and a joint position by that point.
- Expand the planning and analysis scope to address the enlisted and civilian components of the space and missile workforce. They deserve similar consideration, and policies and processes to guide their development and utilization should be designed deliberately to be compatible with and complementary to those for 13S officers.
- Expand the scope to include jobs that are especially closely related to the 13S career field, probably particularly in acquisition, communications and intelligence, and air operations. Not only do many 13S officers need to develop expertise in these areas, but specialists from them need to learn first hand about space and missile operations and issues.

Adapting the Approach for Other Occupations, and Across Career Fields

We believe the approach developed and demonstrated here for the 13S career field is equally applicable to other career fields and, as just suggested, even across career fields. We recommend that Air Force HQ, Deputy Chief of Staff for Personnel and other career-field managers consider the following next steps:

- Officer development specialists should carefully examine these ideas and identify, help develop, and evaluate extensions and revisions needed to enhance their utility.³
- Test the approach in one or more additional career fields. To enhance efficiency, consistency, and accuracy, we strongly recommend using concentrated workshops, rather than administering questionnaires centrally, to identify the education, training, and experience needed for different job groups.⁴ The backgrounds needed for at least some of the jobs below O-4 should also be delineated. Designated subject-matter experts should help develop conventions for interpreting personnel records so that officers' accumulating backgrounds (the supply) can be characterized in the same terms as the jobs' demands. One or more high-level reviewers should carefully examine and possibly revise both the demand and supply data.
- Examine the possibility of applying this approach across career fields, consistent with emerging concepts for developing future leaders with expertise in multiple operational and/or functional areas.

Extending and Improving the Analytic Methods

Finally, the capability and utility of the modeling framework could benefit from further development along the following lines:

- Incorporate selectivity calculations explicitly, to ensure enough officers are available to choose from when filling openings. Those eligible to fill a job should include properly qualified officers who either have enough time left in grade to hold another

³ These specialists include elements in Air Force HQ, Deputy Chief of Staff for Personnel; AFPC; functional manager staffs (especially the career-field managers), AETC, and using MAJCOMs.

⁴ We recommend using such concrete background elements, instead of underlying competencies, because they can be observed objectively and managed deliberately. Education, training, and experience can serve as proxies for competencies. While competencies have the ultimate importance, of course, we believe it is better to continue screening for them as officers progress, working to reward and keep people who develop well and giving them further opportunities to develop and demonstrate their competencies.

position at the job's authorized grade or are about to be promoted into the authorized grade.

- Find ways to solve larger problems that have this underlying mathematical structure, enabling the analysis to distinguish additional types of experience and/or more career stages.
- In parallel with how the model allows some jobs authorized for captains to be filled by lieutenants, allow some of the jobs authorized at higher grades to be filled by officers in adjacent grades. This will relieve the need to adjust retention and promotion rates and job durations to perfectly match the projected inventory with the job counts authorized above O-3.
- Accommodate different lengths of jobs within each grade.
- Explicitly include career stages for technical training, academic coursework, and/or PME.

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13S and Non-13S O-4, O-5, and O-6 Positions

Table A.1
13S O-4 to O-6 Officers Filling Non-13S Duty AFSC Positions at
End of 2001, by Duty AFSC

Duty AFSC	Title	Number
16, F, G, R, P	Operations support	184
30c0	Support command	17
81t0	Instructor	17
82a0	Academic program manager	11
86p0	Command and control	10
21	Logistics	8
62e	Developmental engineers	8
63a	Acquisition manager	8
36	Manpower	7
33s	Communications	6
11, 12, 14, 20, 34, 35, 61, 64, 80, 81, 86, 91, 97	Miscellaneous	58
	Total	334

SOURCE: AFPC historical personnel file, 2001.

Table A.2
O-4 to O-6 Positions in 2001 Rated for Their Requirements, by Command and by Shred (number)

Command	13S						Other						Totals
	A	B	C	D	E	No Shred	10c	87g	88p	91c	91w	97e	
HQ USAF	5	6	4		3	25	5					1	49
AFSPC	48	24	49	20	15	375			1			7	539
CAF	2	1	1	1	4	44	9	2		1	7		72
AFTEC	9	2	1	8	8	4							32
AETC						22	3			1	5		31
AIA	3	2	3		2	11	3	1	1				26
AFMC	1	1				16	2						20
Other Air Force	2	3		1	5	10		1					22
ANG				1		14						1	16
JCS				4	1	18							23
OSD	3				3								6
USSPACECOM	3	1	10	1	4	34	3					1	57
USSTRATCOM	7	3	4	7	4	39		3					67
DTRA	6				1	35							42
Other joint command	5	1	28	3	4	49							90
Totals	94	44	100	46	54	696	25	7	2	2	12	10	1,092

SOURCE: AFSPC authorization file, 2001.

Background Rating Form and Instructions

Figure B.1 reproduces the rating form itself, while Figure B.2 reproduces the instructions for completing it. Tables B.1 through B.3 offer observations about the data. The text of this appendix supplies the instructions for the form as they accompanied it.

Figure B.1
Rating Form

Position group:

	Critical	Important	Useful	Length	Recency		Critical	Important	Useful	Length	Recency
1. Operational experience						5. Degree area (unique to position)					
a A = Satellite C2						a Undergrad:					
b B = Spacelift						b Graduate:					
c C = Missile combat crew											
d D1 = Space surveillance, ground											
e D2 = Space surveillance, orbital											
f E = Space warning, ground											
g Any space or missile ops experience											
h Any space operational experience											
i Combat Rated (fighter, bomber)											
j Any Rated											
k Other:											
2. Previously-held AFS prefix						6. Command experience					
a C = Commander						a Flight					
b B = Squadron Ops Officer						b Squadron					
c K = Instructor						c Ops group					
d Q = Stan/Eval						d Support group					
e R = Contingency/War Planner						e Logistics group					
f S = Safety						f Any group					
g T = Formal Training Instructor						g Wing					
h V = Automated Fctnl Appl Anal						h NAF					
i W = Weapons & Tactics Instr						i Joint					
j X = Nonrated Aircrew						j Center					
k Y = Analytic Studies Officer						k School					
l Other:						l Other:					
3. Prior functional experience						7. Organizational experience					
a Personnel (e.g., DP, A-1, J-1)						a Group-level					
b Intelligence (e.g., IN, A-2, J-2)						b Wing-level					
c Current ops (e.g., XO, DO, A-3, J-3)						c 14th AF (above wing)					
d Logistics (e.g., LG, IL, A-4, J-4)						d 20th AF (above wing)					
e Plans, programs (e.g., XP, A-5, J-5)						e Other NAF (above wing)					
f Communications (e.g., SC, A-6, J-6)						f CAF (ACC, USAFE, PACAF)					
g Requirements (e.g., XR, DR)						g AFSPACE					
h R&D						h AETC					
i Acquisition						i Air Staff					
j Test & evaluation						j AIA					
k Contracting						k NRO					
l Financial management						j JCS or OSD					
m Pol-Mil						m DTRA					
n Education/Training						n SMC					
o Mgt of civilians, contractors						o USSTRATCOM					
p Other:						p USSPACECOM					
q Other:						q AF Test and Evaluation Center					
						r Space Warfare Center (SWC)					
						s Other:					
4. USAF school (unique to position)						8. Combinations or other backgrounds					
a Technical:						a					
b						b					
c PME:						c					
d						d					
e						e					
9. Grade											
a Must hold the authorized grade											

Figure B.2
Instructions for Completing Rating Form

Manpower, Personnel, & Training Program
 RAND

DEVELOPING SPACE CAREER PATHS FOR OFFICERS

RATING EXPERIENCE REQUIREMENTS

PURPOSE

RAND has been asked to assist the Air Force in developing career paths for space officers that will assure the development of the knowledge, skills, and abilities needed for effective use of space assets. To achieve that goal, we must first identify the experiences, training and education needed for all authorized positions at the O-6, O-5, and O-4 levels.

By completing this questionnaire, you will help us to identify requirements for the specific position or group of positions that are identified at the top of the questionnaire. The information that we collect will be used to group positions requiring similar experiences and to develop career paths that maximize opportunities for officers.

INSTRUCTIONS

The rating sheet is divided into nine *experience categories*:

- | | |
|----------------|--------------------------------------|
| 1. Operational | 6. Command |
| 2. AFS prefix | 7. Organizational |
| 3. Functional | 8. Combinations or other backgrounds |
| 4. Training | 9. Grade |
| 5. Educational | |

Ratings

Listed within each of the nine categories are several specific experiences. For each experience listed, please rate whether it is critical, important, or useful to performing the duties associated with the position(s):

Critical: Having acquired the experience, training, or education is *absolutely essential* to effective performance of the job. Without this experience, the position holder *could not perform* the job.

Important: Having acquired the experience, training, or education is *helpful, but not essential* to effective performance of the job. Without this experience, the position holder can still perform the job, although it would be considerably more difficult and time-consuming.

Useful: Having acquired the experience, training, or education is good, but not necessary to perform the job. Without this experience, the position holder can perform the job but with occasional difficulty.

Figure B.2—Continued

Manpower, Personnel, & Training Program
RAND

In addition, for each experience that you rate as **critical**, please indicate the required length and recency of the experience:

Length: The minimum duration of the experience, in years, that would satisfy the requirement.

Recency: Period of time (in years) immediately preceding the taking of the position within which the experience ought to have been acquired. For example, if it were critical that an officer had Satellite Command and Control experience within the past five years, you would rate 1a as critical and enter a 5 in the corresponding recency column.

Multiple requirements Within a Category of Experiences

For some positions, it is likely that more than one type of experience within a category will be rated “critical”, “important”, or “useful.” In these cases, you should consider the following:

- A. If, within a category of experience, you rate as “critical” more than one type of experience, you should rank them from most critical (= 1) to least critical (= 2, and so on). For example, if under Functional Experience you rated Current Ops, R&D, and Acquisition as “critical”, you should rank 1 that experience which is most critical to the position, 2 that experience which is second most critical, and 3 that experience which is least critical of the three.
- B. In instances where multiple experiences within a category are rated as “important”, you should consider whether having acquired at least one of them might be “critical” to performing the job. Enter this information on one of the “other” lines.
- C. Similarly, in instances where multiple experiences within a category are rated as “useful”, you should consider whether having acquired at least one of them might be “important” or even “critical”. Enter this information on one of the “other” lines.

Combination or Other Backgrounds (Item 8 on the Rating Sheet)

In this box, you should indicate experiences that should have been acquired in combination. For instance, if it were critical that experience in Current operations (3c) should be acquired at the 14 AF (7c), this should be indicated in Box 8a by writing in **3c and 7c** and checking the “critical” box.

Table B.1
List of SMC Positions Provided to Experts

RAND ID	org_name	inst_name	posnum	orgstr	orgstr_name	fac	fac_name	pfx	afsc	afsc_name	grade
842	Hq Space Sys	los angeles afb	0015042	caxscm	milstar	6410	enr dev sp milsat		13s4	spc & msl operations	ltc
843	Hq Space Sys	kirtland afb	0021369	caxseb	launch test pgms	6510	oprsysdev test/evl		13s3a	spc & msl ops st c&c	maj
844	Hq Space Sys	kirtland afb	0176222	caxseb	launch test pgms	6510	oprsysdev test/evl		13s3d	spc & msl ops spc sv	maj
845	Hq Space Sys	schriever afb	0013957	caxseo	space test/eval	6510	oprsysdev test/evl		13s3a	spc & msl ops st c&c	maj
846	Hq Space Sys	kirtland afb	0015139	caxseo	space test/eval	6510	oprsysdev test/evl		13s3e	spc & msl ops spc wr	maj
847	Hq Space Sys	los angeles afb	0014635	caxsl	sys acq launch	6410	enr dev sp launch		13s4	spc & msl operations	maj
848	Hq Space Sys	peterson afb	0013924	caxswd	afscn sustainment	6610	acq log afscn		13s3b	spc & msl ops spclft	maj
849	Hq Space Sys	los angeles afb	0014773	caxswn	sys engr/intgr	6410	enr dev sp afscn		13s3d	spc & msl ops spc sv	ltc
850	Hq Space Sys	los angeles afb	0314597	caxszj	csel pgm	6410	enr dev sp gpsjpo		13s3a	spc & msl ops st c&c	maj
851	Hq Space Sys	vandenberg afb	0018206	ccc	sea	1010	command		13s4	spc & msl operations	ltc
852	Hq Space Sys	los angeles afb	0119521	cxri	sys eng intgr div	6710	dev plng space		13s4	spc & msl operations	ltc

Table B.2
Percentage of Positions in Which Raters Agreed
About the Importance of Each Item

Operational experience	
Satellite C ²	84
Spacelift	83
Missile combat crew	86
Surveillance (ground or orbital)	86
Space warning	87
Combat rated pilot	99
Any rated pilot	99
AFSC prefix	
C or B or other command	71
K = Instructor	
or	91
Q = standardization and evaluation examiner	
R = Contingency and war planner	89
S – Safety officer	91
T = Formal training instructor	89
V = Automated functional applications analyst	97
W = Weapons and tactics instructor	90
X = Nonrated aircrew member	98
Y = Analytic studies officer	96
Functional experience	
Personnel	92
Intelligence	92
Current operations	82
Logistics	90
Plans and programs	90
Communications	91
Requirements	92
Research and development	93
Acquisition	91
Test and evaluation	96
Contracting	94
Financial management	83
Political-military	88
Education and training	91
Civilian management	80
Command experience	
Flight	81
Squadron	74
Group	87
Wing	94
Numbered air force	98
Joint command	99
Organizational experience	
Group or wing	82
14th Air Force	90
20th Air Force	93
Combat air force	89
HQ AF Space Command	93
AETC	92
AIA	95
Air Staff, JCS, OSD	88

Table B.2—Continued

DTRA	92
NRO or SMC	86
USSTRATCOM	85
USSPACECOM	86
AFOTEC	91
SWC	91
Grade Rating	73

SOURCE: Survey of senior 13S core Air Force officers.

NOTE: *Agreed* means the two raters rated the item exactly the same or within one scale of one another.

Table B.3
Comparison of Percentage of O-4, O-5, O-6 Positions
Requiring Specified Backgrounds in Original and
Reviewed Ratings

Experience	Original	Reviewed
Operational		
Satellite C ²	13	15
Spacelift	5	9
Surveillance	9	12
Warning	8	11
Any space	19	27
Missile	22	25
Any space or missile	20	27
AFSC prefix		
C = Commander	9	11
B = Squadron ops officer	11	9
K = Instructor	32	26
Q = Standardization and evaluation examiner	31	23
R = Contingency and war planner	10	7
S = Safety officer	3	1
T = Formal training instructor	6	2
V = Automated functional applications analyst	1	0
W = Weapons and tactics instructor	10	6
X = Nonrated aircrew member	3	3
Y = Analytic studies officer	2	1
Functional		
Personnel	2	0
Intelligence	4	2
Current Ops	35	33
Logistics	8	2
Plans and programs	22	12
Communications	6	1
Requirements	14	11
Research and development	7	2
Acquisition	14	10
Test and evaluation	17	7
Political-military	4	1
Command		
Flight	23	23
Squadron	11	10
Any group	4	2
Wing	1	0
Organizational		
Group or wing	27	26
14th Air Force	10	6
20th Air Force	10	7
Combat air force	10	6
AFSPC	31	26
AIA	1	0
DTRA	4	1
AFOTEC	3	1
NRO	12	8
SMC	8	6
SWC	4	1

Table B.3—Continued

Experience	Original	Reviewed
Air Staff, OJCS, OSD	22	18
Unified Command	17	14
Education		
Engineering	15	2
Space operations	0	1
Mathematics	0	0
Physical science	19	4
Grade rating	60	88

SOURCES: Survey of senior 13S core Air Force officers and review focus groups of senior 13S core Air Force officers.

13S Officers: Selected Characteristics

Table C.1
Retention Rate of the 1975, 1980, 1985, 1990 Cohorts of All Officers
and of Officers with Technical Academic Degrees (percent)

Cohort	Officers	1975	1980	1985	1990	1995	2000
1975	All	100	76	68	50	30	16
	With technical degree	100	85	76	65	42	20
1980	All		100	83	74	44	26
	With technical degree		100	90	79	50	36
1985	All		7	100	79	41	30
	With technical degree			100	80	42	31
1990	All				100	86	68
	With technical degree				100	85	69

SOURCE: AFPC historical personnel data.

NOTES: The rates are the percentages of the original cohort remaining in the active force as of the year shown. Includes officers who had at least one tour in a 13S duty AFSC position during their career.

Table C.2
Percentage of Officers with a
Technical Academic Degree at Entry
in the Force, by Year of Entry

Year of Entry	Technical Degree (%)
1975	28
1980	19
1985	49
1990	50
1995	49
2000	51

SOURCE: AFPC historical personnel data.

Table C.3
Percentage of 13S Core Officers by Type of Operational Experience and by Grade, 2001

Operational Experience	O-3	O-4	O-5	O-6
None	5.5	1.8	2.4	0.6
One system only				
Missile	72.1	28.3	43.2	39.1
Satellite C ²	12.1	8.0	5.0	1.3
Lift	1.6	0.5	0.7	1.9
Surveillance	1.7	0.5	1.0	1.3
Warning	1.0	1.4	1.7	2.6
Surveillance and warning	1.4	4.6	6.7	2.6
Subtotal	90.2	43.3	58.3	48.8
Missile and one space system				
Satellite C ²	1.1	15.8	4.3	3.8
Lift	0.4	6.9	5.0	4.5
Surveillance and warning	1.8	11.9	10.2	23.7
Subtotal	3.3	34.6	19.5	32.0
Two space systems				
Satellite C ² and lift		2.8	1.7	
Satellite C ² and surveillance and warning	0.8	8.4	8.6	7.1
Lift and surveillance and warning	0.2	1.4	2.1	1.9
Subtotal	1.0	12.6	12.4	9.0
Three or more systems				
Missile and two space		6.4	5.7	8.3
Three space or more		1.4	1.7	1.3
Subtotal		7.8	7.4	9.6
Total	100.0	100.0	100.0	100.0
N	1,342	787	421	156

SOURCE: AFPC historical personnel file.

135 Officers: Selected Characteristics C-3

[illegible]

Table C.5
Percentage of Officers Promoted by Grade, First Operational Experience Acquired and Cohort, 1975–1995

Cohort Year	Officers in Cohort (no.)		Promotion Rate (%)									
			O-2		O-3		O-4		O-5		O-6	
	Missile	Space	Missile	Space	Missile	Space	Missile	Space	Missile	Space	Missile	Space
1975	300	14	94.5	92.8	94.1	90.0	82.4	88.9	61.8	75.0	45.0	100.0
1976	412	24	98.5	95.8	89.9	87.0	79.7	62.5	69.7	85.5	41.1	75.0
1977	416	51	99.0	98.0	89.9	86.0	80.7	75.0	85.7	68.2	56.0	50.0
1978	422	51	98.8	98.0	87.1	84.0	86.5	84.4	63.1	69.6	—	—
1979	476	91	97.9	95.6	90.9	83.0	79.6	69.5	67.2	71.1	—	—
1980	459	51	98.5	96.1	89.3	85.4	73.0	75.9	55.8	80.0	—	—
1981	421	57	97.6	100.0	88.5	79.6	68.9	69.0	56.7	93.3	—	—
1982	391	49	97.7	100.0	93.9	91.5	69.1	73.1	62.2	60.0	—	—
1983	345	151	97.3	98.7	91.4	93.2	71.3	48.6	62.9	57.1	—	—
1984	372	103	97.6	99.0	94.7	94.0	61.2	78.3	62.6	54.3	—	—
1985	287	124	99.6	99.2	93.6	93.4	71.2	65.8	—	—	—	—
1986	332	139	97.2	100.0	93.8	88.8	80.8	84.2	—	—	—	—
1987	312	147	99.3	100.0	96.5	85.3	85.8	82.4	—	—	—	—
1988	338	54	98.8	96.2	97.5	91.7	84.0	79.2	—	—	—	—
1989	346	84	99.4	98.8	94.2	91.4	85.6	86.3	—	—	—	—
1990	194	70	98.4	97.1	96.1	92.2	—	—	—	—	—	—
1991	308	119	96.0	100.0	98.6	98.3	—	—	—	—	—	—
1992	263	90	98.9	100.0	95.2	95.5	—	—	—	—	—	—
1993	233	89	98.3	100.0	95.5	94.3	—	—	—	—	—	—
1994	157	68	94.9	100.0	100.0	92.4	—	—	—	—	—	—
1995	228	29	97.8	96.6	94.4	92.8	—	—	—	—	—	—
Average	97.9	98.2	93.6	90.0	77.5	74.9	64.8	66.4	47.4	75.0		

SOURCE: AFPC historical personnel records.

Trends in 13S Officers' Acquired Backgrounds, 1986–2000

Table D.1
Percentage of 13S Core Officers with Specified Backgrounds Prior to Entering Their Last Job, 2001

Background Acquired	O-4	O-5	O-6
Operations			
Satellite C ²	44	29	20
Spacelift	18	20	21
Surveillance	13	10	13
Warning	9	5	5
Surveillance and warning	20	31	40
Missile	70	71	80
APS Prefix			
C = Commander	4	29	81
B = Squadron operations officer	7	35	30
K = Instructor	53	48	47
Q = Standardization and evaluation examiner	40	41	34
R = Contingency and war planner	6	8	6
S = Safety officer	1	3	2
T = Formal training instructor	25	23	15
V = Automated functional applications analyst	3	5	11
W = Weapons and tactics instructor	5	2	—
X = Nonrated aircrew member	3	11	13
Y = Analytic studies officer	1	2	5
Functional			
Personnel	5	9	9
Intelligence	6	7	8
Current ops	84	91	97
Logistics	34	33	35
Plans and programs	23	44	69
Communications	11	11	9
Requirements	18	20	20
Research and development	9	8	6
Acquisition	14	17	24
Test and evaluation	15	15	10
Political-military	3	7	22
Organization			
Group	33	29	58
Wing	51	70	81
14th Air Force	5	4	4
20th Air Force	6	8	6
Other numbered air force	1	5	3
Combat air force	10	26	22
AFSPACE	25	35	38

Table D.1—Continued

Background Acquired	O-4	O-5	O-6
AIA	4	4	6
DTRA	1	2	3
AFOTEC	3	3	2
NRO	7	5	10
SMC	7	10	15
SWC	6	2	3
Air Staff	6	25	44
OJCS,OSD	2	14	36
USSTRATCOM	10	19	11
USSPACECOM	12	18	21
Command			
Squadron	—	29	79
Operations group	—	1	23
Any group	—	3	39
Wing	—	—	5
Numbered air force, joint command	—	3	8
Center and other	1	2	2
Education			
Engineering	26	12	6
Other technical	29	30	27
Professional Military Education			
Squadron Officer School	100	99	91
Intermediate Service School	10	100	100
Senior Service School	—	63	100
Air Warfare School	1	2	6
Joint Command Officer School	1	24	24

SOURCE: AFPC historical personnel data.

NOTES: A bar means that no officer of the specified grade has acquired the specified experience. Backgrounds accumulated up to, but not including, the job the officers filled in 2001.

Table D.2
Percentage of All 135 Officers with Selected Backgrounds by Year, 1986–2001

Background	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
satc2	8.6	9.9	11.1	14.2	14.0	17.5	22.6	25.0	27.9	23.3	24.7	24.9	27.1	29.2	27.8	28.6
spclift	0.7	0.8	0.8	1.0	0.9	1.7	2.6	4.4	7.2	6.6	8.2	9.3	10.8	12.7	12.4	13.7
missile	74.7	75.7	75.1	69.3	71.9	68.5	65.9	64.2	62.8	65.5	71.1	70.3	72.1	76.2	75.6	77.7
survgnd	14.0	14.8	15.9	18.7	17.3	18.5	20.3	21.9	23.8	17.9	18.9	18.6	19.1	20.3	19.6	20.2
survorb	4.7	4.9	5.3	6.4	6.0	6.9	7.3	8.2	9.0	6.6	6.8	6.9	6.9	7.8	8.5	9.3
warning	16.4	17.0	18.2	20.7	19.0	20.1	22.4	24.2	25.8	20.0	20.5	20.2	20.3	21.1	19.7	20.5
anyspcmsl	91.4	93.6	93.9	92.6	94.2	94.4	97.0	97.6	97.8	93.6	97.5	95.2	95.9	98.3	95.3	96.5
anyspc	25.5	27.0	28.8	34.2	31.9	36.4	42.6	45.9	51.0	42.3	44.5	45.4	48.9	53.5	52.4	55.4
cmbreated	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.3	1.2	0.4	0.4	0.3	0.3	0.4	0.3
anyrated	0.6	0.5	0.6	0.6	0.6	0.5	0.4	0.3	0.5	1.8	0.6	0.5	0.6	0.6	0.7	0.5
pfxC	3.9	4.3	5.2	6.2	6.4	6.7	7.8	9.8	11.1	9.1	10.5	10.8	10.8	11.7	11.0	10.4
pfxB	2.1	2.5	3.1	3.5	3.8	4.2	5.2	6.0	7.2	6.2	6.7	7.1	7.6	8.7	8.4	8.6
pfxK	25.4	27.7	29.0	30.7	29.3	30.7	34.3	37.4	39.5	36.9	40.3	39.9	41.2	46.2	43.0	45.8
pfxQ	15.2	16.5	19.1	21.2	20.6	21.9	24.0	26.0	28.5	23.3	25.4	25.1	25.2	27.8	26.0	26.8
pfxR										0.5	1.4	2.1	2.6	3.5	3.6	4.0
pfxS	1.8	1.7	1.6	1.6	1.3	1.2	1.2	1.3	1.3	1.0	1.0	1.0	0.9	1.0	0.8	0.9
pfxT	8.5	8.9	10.0	11.7	11.4	12.3	14.1	16.0	18.0	13.9	15.4	15.1	16.1	17.3	16.0	16.1
pfxV	3.0	3.0	3.3	3.3	3.2	3.0	3.2	3.7	3.9	3.0	2.9	2.7	2.6	2.8	2.2	2.1
pfxW					0.0	0.0					0.3	0.9	1.6	2.1	2.5	3.1
pfxX	4.2	4.3	4.4	4.9	4.7	4.7	4.5	4.5	4.6	3.3	3.7	3.6	3.6	3.8	3.3	3.2
pfxY	0.7	0.7	0.8	0.9	0.8	0.9	1.0	1.2	1.2	0.9	1.0	1.0	0.9	0.9	0.8	0.8
person	1.3	1.7	1.7	1.8	1.8	1.9	2.1	2.3	4.0	3.4	3.9	4.3	4.1	4.4	4.0	4.0
intel	2.0	2.3	2.3	2.5	2.5	2.5	3.1	3.8	4.5	3.6	4.0	3.8	3.9	4.2	4.2	4.4
currops	60.0	63.1	66.0	71.1	69.4	69.3	69.4	68.4	69.5	54.8	58.2	54.8	54.0	57.5	52.3	52.4
logistic	17.0	18.6	21.1	23.8	22.4	23.1	31.8	35.4	37.2	26.8	26.0	23.8	22.2	21.8	18.5	17.7
planspro	6.6	7.0	8.3	10.2	9.8	11.3	13.3	14.9	17.4	13.8	14.8	15.5	16.3	18.8	18.0	17.6
comm	2.2	2.4	2.7	2.9	2.7	2.6	2.8	3.0	3.5	3.1	4.3	5.2	5.8	6.7	6.3	6.7
require	0.1	0.2	1.0	1.4	2.3	2.4	2.5	3.7	7.2	6.4	8.1	8.9	10.3	12.0	12.2	12.3
rand	0.6	0.7	0.8	1.4	1.4	1.8	2.3	3.0	4.6	4.4	5.1	4.8	5.6	5.8	5.4	5.7
acquis	6.0	6.0	6.8	7.5	6.4	6.6	7.3	8.1	10.2	8.1	9.1	9.4	10.2	11.0	10.3	10.0
testeval	1.9	1.8	2.0	2.3	2.2	3.4	4.7	5.6	6.6	5.4	6.8	6.8	7.8	8.9	8.5	9.0
contract	0.3	0.4	0.7	0.7	0.4	0.5	1.2	1.6	1.3	0.4	0.2	0.4	0.3	0.3	0.3	0.3
finmgt	0.2	0.4	0.3	0.3	0.2	0.2	0.4	0.4	0.6	0.4	0.5	0.5	0.4	0.3	0.3	0.3
polmil	0.7	0.7	1.1	1.5	1.7	2.1	2.5	3.1	3.6	3.1	3.6	4.0	4.3	4.6	4.5	4.3
eductrn	21.6	23.5	26.3	30.7	28.2	29.5	33.6	37.4	42.2	36.7	40.4	47.0	51.6	54.5	60.0	63.1
FTcc												0.1	0.1	0.1	0.1	0.1

Table D.2—Continued

SQcc	1.9	2.3	3.0	3.6	3.9	4.2	5.3	6.7	8.0	6.8	7.6	7.8	8.6	9.5	9.1	8.7
opsGPcc						0.1	0.1	0.2	0.5	0.6	0.9	1.1	1.3	1.5	1.5	1.7
supGPcc	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.8	1.0	1.1	1.1	1.0
logGPcc							0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.1
GPcc	0.3	0.4	0.5	0.6	0.7	0.9	1.0	1.2	1.7	1.7	1.9	2.2	2.6	2.8	2.9	2.8
WGcc			0.0	0.1	0.2	0.3	0.5	0.6	0.6	0.4	0.5	0.6	0.6	0.6	0.5	0.6
NAFcc	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.2	0.2	0.2	0.2	0.3
JTcc	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.6	0.7	0.5	0.7	0.8	0.8	0.9	0.8	1.0
CTcc										0.1	0.1	0.1	0.1	0.1	0.1	0.1
SCcc	0.9	0.9	0.8	0.8	0.7	0.6	0.6	0.6	1.0	0.7	0.9	0.9	0.9	0.9	0.7	0.7
SPOdir																
GP	8.1	8.7	10.8	12.8	12.6	13.6	17.0	18.4	21.2	17.0	20.5	22.0	23.4	26.0	24.9	26.1
WG	53.9	54.5	53.3	53.9	49.5	50.5	49.5	49.0	49.3	35.6	37.1	33.8	32.6	33.6	29.4	28.2
NAF14								0.1	0.6	0.7	0.8	1.1	1.6	2.1	2.4	2.8
NAF20	1.4	1.3	1.4	1.5	1.4	2.9	2.8	2.9	3.7	3.2	3.7	3.8	4.0	4.4	4.0	3.8
NAFoth	1.2	1.8	1.7	1.9	1.8	1.7	1.7	1.7	1.7	1.3	1.4	1.3	1.4	1.4	1.4	1.5
CAF	13.8	15.8	15.1	14.3	11.8	10.7	11.6	12.3	12.6	10.5	12.9	12.3	13.7	14.9	14.1	15.1
AFSPC	4.4	5.0	5.8	7.0	6.7	7.4	8.4	10.7	13.8	11.3	12.1	12.8	13.4	15.1	15.2	16.0
AETC	13.1	14.0	15.0	16.8	15.4	16.3	19.5	25.6	28.7	28.7	32.2	39.6	44.4	46.5	53.3	56.3
AirStaff	2.1	2.2	2.8	3.5	3.8	4.3	5.3	6.3	7.0	5.6	6.2	6.1	6.6	7.6	7.5	8.2
AIA	0.7	1.0	1.1	1.1	1.1	1.2	1.7	2.2	2.5	2.1	2.5	2.4	2.6	2.9	2.9	3.2
NRO	0.8	0.9	1.2	1.4	1.4	1.6	1.9	2.5	2.9	2.4	3.1	3.4	3.4	4.0	4.0	4.1
JCSOSD	0.2	0.4	1.2	1.9	2.2	2.8	3.5	4.2	4.7	3.9	4.5	4.6	4.7	5.2	5.1	5.0
DTRA										0.4	0.5	0.5	0.7	0.9	1.6	1.8
SMC	5.6	5.4	6.1	6.5	5.3	5.6	6.1	6.4	6.9	5.1	5.2	5.1	5.8	6.0	5.6	5.1
USSTRAT							1.4	3.0	3.8	3.8	4.7	5.2	5.8	6.6	6.2	6.7
USSPACE	1.4	2.2	2.5	3.4	3.5	4.3	5.0	5.9	6.6	5.6	6.0	6.2	6.9	8.2	7.4	8.1
AFTEC	0.8	0.8	0.9	1.1	1.0	1.1	1.3	1.7	1.9	1.5	1.6	1.7	2.0	2.1	2.1	2.2
SWC									0.4	0.7	1.1	1.7	2.1	2.8	2.8	2.8
Unified	0.6	0.8	0.8	1.2	1.3	1.4	1.7	2.3	2.4	2.3	3.1	3.2	3.8	4.2	4.1	4.7
NASA	1.4	1.8	1.8	1.7	1.4	1.4	1.5	1.6	1.6	1.1	1.1	1.0	0.9	0.9	1.0	0.7
MTC							2.7	3.0	4.1	3.7	4.8	5.1	5.9	6.4	6.1	5.7

SOURCE: AFPC authorized personnel data.

NOTE: The data include all 135 core officers or equivalent in years preceding 1993.

13S Job Groups for Flow Modeling

Table E.1 shows the gain and demand patterns for these job groups as described in Chapter Five.

The table's left-hand section reflects the experience gained on the job, and its center section reflects the experience needed for it. For example, the first three groups total 737 jobs: All three groups provide experience in missile operations; 27 are O-4 jobs for which prior missile experience is critical (rating = 3); nine are O-5 jobs for which prior missile experience is important (rating = 2); and 262 and 439 are O-1/2 and O-3 jobs, respectively, for which no other prior experience requirements were designated. The total is 3,342 jobs for 13S officers.¹

¹ In addition to 13S positions, the model includes 46 related positions and 443 non-13S positions regularly filled by 13S core officers.

Table E.1
Experience Gained and Experience Demanded by Group of Jobs

gain pattern	Mission	Function										Organization						Cmd cmd	demand pattern	Function										Organization						Cmd cmd	Number of jobs																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
		msl			spc			eth				acq			rqt					plpr				ospt			tldr			stf			jstf				ostf			O-1/2			O-3			O-4			O-5			O-6			Total																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth			acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr		ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf		cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr	ospt	tldr	stf	jstf	ostf	cmd	pattern	msl	spc	eth	acq	rqt	plpr

Table E.1—Continued

[illegible]

Table E.1—Continued

gain pattern	mission												mission												Number of jobs								
	Mission			Function			Organization			Cmd			demand pattern			Mission			Function			Organization			Cmd			O-1/2	O-3	O-4	O-5	O-6	Total
	msl	spc	eth	acq	rtg	plpr	ospt	tldr	stf	jstf	ostf	cmd	msl	spc	eth	acq	rtg	plpr	ospt	tldr	stf	jstf	ostf	cmd									
157	gnp30						1				1	dmp001	3														10		10				
158												dmp027	2		1	1			1			1					3		3				
159							1					dmp041		3							1		1				6		6				
160							1					dmp129		2	1	1		1				2					4		4				
161							1					dmp165			3							2					1		1				
162							1					dmp179			2				2										1				
163							1					dmp200							2		2					4	7	1	3	2	17		
164	gnp31							1				dmp001	3														6		6				
165							1					dmp013				1	1			2	1	1	2				15		15				
166							1					dmp014	3			1	1	1			1	1	1				4		4				
167							1					dmp031			2	1				1	1			1			6		6				
168							1					dmp032	1		2	1	2	2	1	2	2		1	2				3	3				
169							1					dmp033	1	1							1						3		3				
170							1					dmp035	1	1						1	1			1			10		10				
171							1					dmp040		3													7		7				
172							1					dmp052		3			1										9		9				
173							1					dmp071		2													8		8				
174							1					dmp076		2							2						1		1				
175							1					dmp078		2									2				6		6				
176							1					dmp087		2						2	3			2				1	1				
177							1					dmp099		2		1					1		1				7		7				
178							1					dmp117		2		2	3	2	1		2	2	2	1				3	3				
179							1					dmp123		2		3	3	2	1		3	3	2	1				3	3				
180							1					dmp124		2		3	3	2	2		3	3	3				5		5				
181							1					dmp136		1				1			2	1					2		2				
182							1					dmp138					1			1	2						10		10				
183							1					dmp139		1				2	1								2		2				
184							1					dmp150			1	1					1						10		10				
185							1					dmp154		1	1	1	1	1			1		1	1			3		3				
186							1					dmp155		1	1	1	1	1		1	1			3				4	4				
187							1					dmp158			1	2											8		8				
188							1					dmp161		1	3		1	1		1	2			2				6	6				
189							1					dmp168			3					1	1		1				17		17				
190							1					dmp177			2						1			1				3	3				
191							1					dmp189			1												15		15				
192							1					dmp191			1	1	1	1			2	1	1				2		2				
193							1					dmp194				2											1		1				
194							1					dmp200														29	192	47	31	11	310		
195	gnp32						1				1	dmp009	3							3		3						2		2			
196							1					dmp044		3							3		3					2		2			
197							1					dmp125		2		3	3	3		3	3	2	3	3				1	1				
198							1					dmp190			1					1	3	1	2	3				3		3			
199							1					dmp200															3	13	14	30			
200	gnp33							1				dmp001	3															1		1			
201								1				dmp005	3							1								4		4			
202							1					dmp011				1		1		1	1	1	1	1				8		8			
203							1					dmp012	3			1	2			3	2	2	2	1				4		4			
204							1					dmp022			2	2	2			2	2	2	2				9	6	15				
205							1					dmp028	2	1		1		1		1	1	1	1				11		11				
206							1					dmp034		1	1						1			1				6		6			
207							1					dmp040			3												1		1				
208							1					dmp047			3					2			2				2		2				
209							1					dmp071			2												2		2				
210							1					dmp072			2							1					8		8				
211							1					dmp092			2			1		1	1	1	1					6	6				
212							1					dmp126			2	1											15		15				
213							1					dmp134										1					8		8				
214							1					dmp148			1	1						1					6		6				
215							1					dmp162				3											1		1				
216							1					dmp200														1	27	28	18	6	80		
217	gnp34							1	1			dmp010	3							3		2		3				1		1			
218								1	1			dmp043		3							3		2	3				1		1			
219								1	1			dmp045		3							3	2	2	2					1	1			
220								1	1			dmp051		3					2		3	2	2					1		1			

Case 2 Inventory

Table F.1 shows the outcome of the optimization model for Case 2 (optimization, ladders, depth), as described in Chapter Six. Its left-hand section reflects the categories of experience accumulated up to but not including the given career stage, and its right-hand section reflects the average inventory of officers who would bring that set of types of prior experience to their current jobs. For example, an average of 469.3 officers would have entered the first career stage s1 with experience profile p0001, reflecting no prior experience. Averages of 251.7 and 115.4 would have entered career stages s2 and s3, respectively, with experience profile p0513, reflecting prior experience only in space operations.

Near the end of the table are the numbers of experience profiles observed among officers entering each career stage—e.g., an officer entering stage s6, the first as a major, would bring one of 62 experience profiles (compared with the 1,422 that Table 5.4 says are possible). Inventory values are highlighted if they are among the largest at the career stage: the largest 25 percent of the profiles are shaded, and the top 10 percent are shaded even darker. For example, 16 profiles are highlighted for stage s6, and seven of them are shaded even darker. Note that 51 percent of stage s6's inventory would enter with one of the top four profiles, 75 percent with one of the top 14 profiles, and 90 percent with one of the top 30 profiles, leaving 10 percent spread among the remaining 32 profiles. Clearly, those who plan and/or guide officer development and utilization could handle most assignments by concentrating on relatively few of the profiles that are theoretically possible at each stage.

Table F.1
Experience Accumulated by Officers by Grade and by Stages Within Grade

Entry profile	Long-run inventory of 13S officers (Case 2: optimization, ladders, depth)													Total													
	Mission			Function			Organization			Cmd cmd	O-1/2		O-3		O-4		O-5		O-6								
	msl	spc	eth	acq	rpt	plpr	ospt	tltr	stf		stf	ostf	s1		s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	
p0001												469.3													469.3		
p0009								1					7.1												7.1		
p0035							1				1		1.0												1.0		
p0259				1							1		7.0												7.0		
p0513		1	1										251.7	115.4	86.6	41.4	26.0	4.5	4.4	.8	.7	.4	.3	.4	532.8		
p0514		1	1								1								2.9	.4	.2	.1	.2		3.8		
p0515		1	1								1				3.9		8.7	5.1	.2	.2					18.1		
p0517		1	1							1							6.9	2.0	1.7	.7	.4	.3	.4		12.4		
p0519		1	1							1	1										.1	.1	.1	.1	4		
p0521		1	1						1					71.3	47.4	24.5	12.0	9.7	4.8	1.3	.4	.2	.1	.2	171.8		
p0522		1	1						1			1						4		2.8	2.3	1.4	.9	1.3	9.2		
p0523		1	1						1		1				2.3		7.6	3.3	1.2	1.0					15.3		
p0525		1	1						1	1								9	9.5						10.4		
p0526		1	1						1	1		1								8.0	6.7	4.2	2.7	2.4	24.0		
p0527		1	1						1	1	1								2.0		.6	.4	.2		3.2		
p0528		1	1						1	1	1	1												.3	3		
p0529		1	1						1										1.0						1.0		
p0537		1	1						1	1				.0					.9	.8					1.8		
p0538		1	1						1	1		1							.4	.3	.3	.2	.1	.2	1.4		
p0545		1	1				1								4.1	7.0			2.9						14.0		
p0547		1	1				1				1			1.8	.9				1.0						3.7		
p0551		1	1				1				1	1					8								8		
p0553		1	1				1		1						3.1	8.2									11.3		
p0555		1	1				1		1		1				2.0			10.1	1.8	1.7	1.4				17.0		
p0557		1	1				1		1	1												.0	.0	.0	.1		
p0559		1	1				1		1	1	1							11.1	1.0			1.2	.7	.5	.3	14.8	
p0560		1	1				1		1	1	1	1													.4	4	
p0563		1	1				1	1			1			.8												8	
p0571		1	1				1	1	1		1				.0											.0	
p0577		1	1			1													7.3	1.0	.8	.7	.4	.3	.4	11.0	
p0579		1	1			1					1									2.4	2.0	1.1	.7	.4	.6	7.1	
p0583		1	1			1				1	1										.6					6	
p0585		1	1			1			1							1.6		.8	4.6	3.9	2.9	1.8	1.2	1.6		18.3	
p0589		1	1			1			1	1												1.0				1.0	
p0591		1	1			1			1	1	1												1.0	.6		1.6	
p0592		1	1			1			1	1	1	1	1												.9	9	
p0601		1	1			1		1	1									1.4	1.3	1.3	1.1					5.0	
p0609		1	1			1	1												.9							9	
p0617		1	1			1	1		1										.1	1.0	.8					1.9	
p0621		1	1			1	1		1	1												.7	.4	.3	.4	1.8	
p0641		1	1			1														.3	.3	.3				9	
p0643		1	1			1					1								2.0	1.9	1.6					5.5	
p0645		1	1			1				1												.2	.1	.1	.1	6	
p0647		1	1			1					1	1										1.4	.8	.5	.8	3.5	
p0769		1	1	1											3.4		31.0	1.0	1.3	1.3	1.1					39.1	
p0771		1	1	1							1				13.3	2.9	10.6	21.7	1.4	6.2						56.2	
p0772		1	1	1							1	1							1.3							1.3	
p0775		1	1	1							1	1														11.0	
p0777		1	1	1							1			1.0			.1	1.0	6.4			.6	.1	.1	.1	9.4	
p0779		1	1	1							1					3.1	8.8	4.0	3.7	3.6	1.1	1.2	.7	.5	.7	27.4	
p0780		1	1	1							1	1	1				.8									8	
p0781		1	1	1							1	1						.9	.3							1.3	
p0782		1	1	1							1	1														1.4	
p0784		1	1	1							1	1	1	1								1.7	.7	.5	.3	3.2	
p0785		1	1	1					1									4.1	.6							4.7	
p0787		1	1	1					1			1						.5	.4	.4	.4					1.7	
p0788		1	1	1					1			1	1							1.3	1.1	1.2	.7	.5		4.7	
p0793		1	1	1					1	1										3.8	4.3	3.6				11.7	
p0801		1	1	1					1								.4	1.6								2.1	
p0803		1	1	1					1			1					4.9	1.5								6.4	
p0809		1	1	1					1		1						2.7									2.7	
p0811		1	1	1					1		1	1					.7	2.9			1.0					4.6	
p0815		1	1	1					1		1	1	1				.6				10.9	10.1	3.9	2.4	1.6	2.2	31.7
p0819		1	1	1					1	1		1							2.3	.3	.3	.3				3.2	
p0828		1	1	1					1	1	1	1	1	1								.2	.1			4	
p0835		1	1	1					1			1							2.7							2.7	
p0841		1	1	1					1										.1				.6			.7	
p0843		1	1	1					1			1							2.2							5.2	
p0845		1	1	1					1		1									.8	.3			.4	.2	.3	1.2
p0847		1	1	1					1		1	1									.8	1.0					6.6
p0848		1	1	1					1	1	1	1	1									1.5	.9	.6	1.3	4.3	

Table F.1—Continued

[illegible]

Table F.1—Continued

Entry profile											Long-run inventory of 13S officers (Case 2: optimization, ladders, depth)															Total			
	Mission		space		missile or space		acquisition		requirements		plane, programs		comm or intel		military, air staff		unified cmd, ocs, oed		other staff		command								
	msl	spc	eth	acq	rqt	plpr	ospt	tlcr	stf	jstf	ostf	cmd	O-1/2	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13			
p1297	1		1	1				1			1								.8								.8		
p1299	1		1	1				1			1					5.9	2.3			.7	.7	.6					10.2		
p1303	1		1	1				1		1	1						.7									.7			
p1307	1		1	1				1	1		1						2.2		1.4	1.0	.9	.8				6.3			
p1308	1		1	1				1	1		1	1						2.2				.5	.3	.2		3.2			
p1311	1		1	1				1	1	1	1							1.6	6.0							7.6			
p1313	1		1	1				1										1.0								1.0			
p1315	1		1	1				1			1								1.4	1.3		.1	1.8	1.1	.7	1.0	7.4		
p1335	1		1	1				1	1		1	1					4.1									4.1			
p1359	1		1	1				1		1	1	1						1.7								1.7			
p1375	1		1	1				1	1	1	1	1							1.6	7.3	7.1	3.0	.7	.4	.3	.4	20.7		
p1376	1		1	1				1	1	1	1	1	1						1.4	1.3	1.3	1.1	3.4	2.1	.7	1.3	12.6		
p1407	1		1	1				1	1	1	1	1										3.1	.1	.1			3.3		
p1417	1		1	1				1													.1	.6	.5	.6	.4	.6	2.7		
p1419	1		1	1				1			1								1.5			1.2					2.7		
p1439	1		1	1				1	1	1	1	1						.7								.7			
p1441	1		1	1				1												.0						.0			
p1443	1		1	1				1												1.3	1.3					2.5			
p1447	1		1	1				1			1	1									.9	1.8				2.7			
p1467	1		1	1				1	1	1	1	1							2.6							2.6			
p1471	1		1	1				1	1	1	1	1						3.9								3.9			
p1487	1		1	1				1	1	1	1									1.3	1.3	1.1	2.0	1.2	.8	1.1	8.9		
p1513	1		1	1				1													.0					.0			
p1515	1		1	1				1	1	1	1										.4	.3				.7			
p1519	1		1	1				1	1	1	1	1											1.8	1.1	.7	.7	4.3		
p1520	1		1	1				1	1	1	1	1	1													.3	.3		
p1535	1		1	1				1	1	1	1	1	1									2.5	1.5	1.0			5.0		
p1536	1		1	1				1	1	1	1	1	1	1											1.5	1.5			
p1537	1	1	1	1															4.2		.5					4.7			
p1538	1	1	1	1								1										.4	2.4	1.5	1.0	1.4	6.7		
p1545	1	1	1	1				1											.2	2.1	2.0	.8				5.0			
p1546	1	1	1	1				1				1								.1		.9	.6	.4	.3	.4	2.7		
p1550	1	1	1	1					1	1		1											.1	.1	.1	.1	.3		
p1553	1	1	1	1				1								2.1											2.1		
p1561	1	1	1	1				1	1							1.4											1.4		
p1562	1	1	1	1				1	1			1									.1	.1	.8	.5	.3	.4	2.2		
p1601	1	1	1	1				1												1.8							1.8		
p1603	1	1	1	1				1			1										1.6	1.4					3.0		
p1609	1	1	1	1					1												.2	.2	.7				1.0		
p1610	1	1	1	1				1		1		1											.5				.5		
p1612	1	1	1	1				1			1	1	1										1.1				1.1		
p1614	1	1	1	1				1		1	1	1	1											.3	.2		.5		
p1616	1	1	1	1				1		1	1	1	1	1										.7	.5	.9	2.1		
p1626	1	1	1	1				1	1	1		1											.9	.6	.4		1.8		
p1737	1	1	1	1				1	1														.1	.5	.3	.5	1.4		
p1754	1	1	1	1				1	1			1													.5		.5		
p1793	1	1	1	1								1								.2							.2		
p1794	1	1	1	1																	.2						.2		
p1795	1	1	1	1							1									1.5							1.5		
p1809	1	1	1	1				1												2.7							2.7		
p1810	1	1	1	1				1				1										.2	.2				.4		
p1811	1	1	1	1				1			1																6.8		
p1812	1	1	1	1				1			1	1	1										.1	.1	.1		.3		
p1815	1	1	1	1				1		1	1																2.0		
p1817	1	1	1	1				1	1							.1											.1		
p1818	1	1	1	1				1	1			1															.1		
p1819	1	1	1	1				1	1		1								8.6	5.7	8.0	6.8					29.1		
p1820	1	1	1	1				1	1		1	1	1						.5	.7					.8		1.9		
p1823	1	1	1	1				1	1	1	1	1									3.0						3.0		
p1824	1	1	1	1				1	1	1	1	1	1	1								4.9	4.1	3.5	2.2	1.4	2.0	18.0	
p1841	1	1	1	1				1	1										.9								.9		
p1851	1	1	1	1				1	1	1	1																.1		
p1881	1	1	1	1				1	1	1										.1	.1	.1	.0				.2		
p1883	1	1	1	1				1	1	1	1									2.0							2.0		
p1884	1	1	1	1				1	1	1	1	1	1						.6	1.8			.0	.0	.0		2.4		
p1887	1	1	1	1				1	1	1	1	1							5.7	6.2	6.0	1.4	5.6	3.5			28.6		
p1888	1	1	1	1				1	1	1	1	1	1	1									3.2	2.8	3.5	2.2	2.0	2.9	18.6
p1913	1	1	1	1				1	1	1	1									1.2	1.9	1.8	1.6				6.5		
p1915	1	1	1	1				1	1	1	1	1							1.0								1.0		
p1916	1	1	1	1				1	1	1	1	1	1	1						1.0			1.3	.8	.5	.5	4.1		
p1919	1	1	1	1				1	1	1	1	1	1									3.7					3.7		
p1920	1	1	1	1				1	1	1	1	1	1	1	1							.9	.8	3.5	2.2	1.4	.0	8.9	

Table F.1—Continued

Entry profile															Long-run inventory of 13S officers (Case 2: optimization, ladders, depth)													Total	
	Mission				Function				Organization				Cmd																
	msl	spc	elth	acq	rqt	plpr	ospt	ltdr	stf	jstf	ostf	cmd			O-1/2	O-3	O-4	O-5	O-6										
p1931	1	1	1	1	1			1	1		1																	1.4	
p1932	1	1	1	1	1			1	1		1	1							1.6									1.6	
p1936	1	1	1	1	1			1	1		1	1																1.6	
p1945	1	1	1	1	1			1	1		1	1																1.3	
p1947	1	1	1	1	1			1	1		1	1																5.5	
p1948	1	1	1	1	1			1	1		1	1																2.0	
p1951	1	1	1	1	1			1	1		1	1																19.2	
p1952	1	1	1	1	1			1	1		1	1																5.7	
p1979	1	1	1	1	1			1	1		1	1																3.7	
p1980	1	1	1	1	1			1	1		1	1																2.3	
p1983	1	1	1	1	1			1	1		1	1																.5	
p1984	1	1	1	1	1			1	1		1	1																2.8	
p1994	1	1	1	1	1			1	1		1	1																.8	
p1998	1	1	1	1	1			1	1		1	1																.8	
p1999	1	1	1	1	1			1	1		1	1																2.5	
p2000	1	1	1	1	1			1	1		1	1																3.4	
p2011	1	1	1	1	1			1	1		1	1																5.0	
p2012	1	1	1	1	1			1	1		1	1																2.0	
p2015	1	1	1	1	1			1	1		1	1																6.0	
p2016	1	1	1	1	1			1	1		1	1																8.4	
p2026	1	1	1	1	1			1	1		1	1																1.1	
p2030	1	1	1	1	1			1	1		1	1																1.2	
p2032	1	1	1	1	1			1	1		1	1																1.1	
p2043	1	1	1	1	1			1	1		1	1																8.3	
p2044	1	1	1	1	1			1	1		1	1																4.1	
p2047	1	1	1	1	1			1	1		1	1																6.4	
p2048	1	1	1	1	1			1	1		1	1																14.9	
Total															469.3	459.6	385.8	319.9	297.5	270.0	247.8	242.2	205.4	171.4	107.2	68.9	97.1	3,342.0	
Shares															14%	14%	12%	10%	9%	8%	7%	7%	6%	5%	3%	2%	3%	100%	
(at job entry)--> Avg # of experiences															2.0	2.4	2.7	3.4	4.1	5.0	5.3	5.6	6.4	6.5	6.6	6.9	3.4		
															1.0				2.8			4.8		6.1					
No. of entering profiles used															1	6	18	29	44	62	87	91	93	98	93	91	86	243	
percentiles															90%	469.3	221.8	84.5	18.3	10.0	8.5	7.0	6.2	4.5	4.3	2.8	1.9	2.7	17.8
															75%	469.3	146.6	7.9	4.1	5.0	4.1	3.1	3.0	2.5	2.0	1.4	.8	1.3	6.9
															50%	469.3	7.1	3.1	2.3	1.8	1.5	1.4	1.3	1.2	1.0	.7	.5	.6	2.8

Summary Tabulations Comparing Five Optimizations

The first page of Table G.1 shows the numbers (upper panel) and shares of officers who would have each of 12 categories of experience and each of eight combinations of three key categories of experience, under three optimization cases and using 2001's jobs and corresponding demands for experience. For example, under Case 2's development and utilization patterns, an average of 296 (or 61 percent) of 484 lieutenant colonels (O-5s) would have operational experience in missiles; 129 (or 27 percent) would have such experience and lack experience in both space operations and acquisition; 20 (or 4 percent) would have operational experience in both space and missiles but lack experience in acquisition; and 102 (or 21 percent) would have experience in all three areas.

The second page shows similar numbers under two optimization cases that address potential future changes in requirements. For example, under Case 4's flows, an average of 283 (or 58 percent) of 484 lieutenant colonels would have operational experience in missiles; 96 (or 20 percent) would have such experience and lack experience in both space operations and acquisition; 14 (or 3 percent) would have operational experience in both space and missiles but lack experience in acquisition; and 106 (or 22 percent) would have experience in all three areas.

For comparison purposes, both pages also show the corresponding numbers and percentages for the 13S core inventory in 2001. For example, 299 (or 71 percent) of 421 lieutenant colonels had operational experience in missiles; 134 (or 32 percent) had missile experience and lacked experience in both space operations and acquisition; 86 (or 20 percent) had operational experience in both space and missiles but lacked experience in acquisition; and 58 (or 14 percent) had experience in all three areas. When at least 10 percent of 2001's officers at a grade had the designated experience or combination of types of experience, cells are highlighted if the optimized flows would increase or decrease the shares of the inventory with those backgrounds by at least 20 percent, relatively. For example, Case 2's development and utilization patterns would raise the share of O-5s who would have space and acquisition experience but lack missile experience to 26 percent (from 2001's 16 percent), and they would lower the share of O-5s who would have missile and space experience but lack acquisition experience to 4 percent (from 2001's 20 percent).

Table G.1
Summary Comparison of Five Optimization Cases with 2001 Inventory

Alternative optimization objectives, with 2001's jobs and demands for experience																														
2001's 13S core officers							Case 1: initial optimization						Case 2: optimization, ladders, and depth						Case 3: optimization, ladders, and breadth											
	O-1/2	O-3	O-4	O-5	O-6	Total	O-1/2	O-3	O-4	O-5	O-6	Total	O-1/2	O-3	O-4	O-5	O-6	Total	O-1/2	O-3	O-4	O-5	O-6	Total	O-1/2	O-3	O-4	O-5	O-6	Total
total officers	729	1,343	787	421	156	3,436	929	1,003	760	484	166	3,342	929	1,003	760	484	166	3,342	929	1,003	760	484	166	3,342	929	1,003	760	484	166	3,342
No. of officers with experience in each category																														
missile	489	1,204	554	299	125	2,671	596	845	665	429	147	2,682	404	484	418	296	101	1,704	512	903	755	483	166	2,818	512	903	755	483	166	2,818
space	177	790	578	258	100	1,903	479	687	574	374	132	2,246	512	580	486	311	108	1,996	668	803	754	483	166	2,875	668	803	754	483	166	2,875
missile or space	637	1,334	776	413	155	3,315	916	1,003	760	484	166	3,329	913	1,003	760	484	166	3,326	913	1,003	760	484	166	3,326	913	1,003	760	484	166	3,326
acquisition	2	228	266	152	47	695	38	288	417	307	113	1,163	38	311	390	273	98	1,110	38	316	431	320	122	1,227	38	316	431	320	122	1,227
requirements	1	108	179	99	35	422		51	214	218	92	575		51	187	174	75	487		51	219	241	104	615		51	219	241	104	615
plans, programs		58	222	215	111	606		45	200	237	118	600		45	200	220	98	563		45	200	254	144	643		45	200	254	144	643
comm or intel	2	118	142	75	27	364	11	106	192	148	62	520	10	105	147	115	45	422	8	111	204	154	67	544	8	111	204	154	67	544
(group or wing) + (k or q)	37	371	442	270	102	1,222	21	112	213	137	47	530	21	112	213	137	47	530	21	112	213	137	47	530	21	112	213	137	47	530
majcom, air staff		71	355	276	122	824	125	439	637	452	163	1,816	112	304	488	378	136	1,417	153	558	754	484	166	2,115	153	558	754	484	166	2,115
unified cmd, ojcs, osd		91	285	259	107	742	1	80	280	317	129	807	1	80	236	268	104	688	1	80	285	372	154	892	1	80	285	372	154	892
other staff	1	172	262	140	53	628	56	325	488	382	137	1,389	37	282	421	282	104	1,126	41	341	530	461	166	1,540	41	341	530	461	166	1,540
command		33	120	244	138	535		10	74	196	118	399		10	74	196	106	386		10	74	196	120	400		10	74	196	120	400
No. of officers with experience in each combination of missiles, space, and acquisition																														
missile only	460	435	131	134	49	1,209	430	241	138	71	21	901	393	343	214	129	42	1,121	236	93				329	236	93				329
space only	148	82	108	45	11	394	297	103	34	5	2	440	487	343	143	62	18	1,053	380	22				402	380	22				402
acquisition only	1	5	10	4	1	21	7					7	7					7	7					7	7					7
missile and acquisition		109	67	21	6	203	7	76	48	39	12	182	9	80	61	44	15	210	10	106	6	1		123	10	106	6	1		123
space and acquisition		48	114	69	19	250	23	55	60	51	17	207	22	177	200	126	46	570	21	79	5	1		106	21	79	5	1		106
missile and space	28	594	281	86	49	1,038	159	371	171	101	31	832	2	7	13	20	7	50	267	572	329	164	44	1,376	267	572	329	164	44	1,376
all three	1	66	75	58	21	221		158	309	217	83	767		54	130	102	37	323		131	420	318	122	991		131	420	318	122	991
none of the three	91	4	1	4		100	6					6	8					8	8					8	8					8
Share of officers with experience in each category																														
missile	67%	90%	70%	71%	80%	78%	64%	84%	88%	89%	89%	80%	44%	48%	55%	61%	61%	51%	55%	90%	99%	100%	100%	84%	55%	90%	99%	100%	100%	84%
space	24%	59%	73%	61%	64%	55%	52%	68%	76%	77%	80%	67%	55%	58%	64%	64%	65%	60%	72%	80%	99%	100%	100%	86%	72%	80%	99%	100%	100%	86%
missile or space	87%	99%	99%	98%	99%	96%	99%	100%	100%	100%	100%	100%	98%	100%	100%	100%	100%	100%	98%	100%	100%	100%	100%	100%	98%	100%	100%	100%	100%	100%
acquisition	0%	17%	34%	36%	30%	20%	4%	29%	55%	63%	68%	35%	4%	31%	51%	56%	59%	33%	4%	32%	57%	66%	74%	37%	4%	32%	57%	66%	74%	37%
requirements	0%	8%	23%	24%	22%	12%		5%	28%	45%	55%	17%		5%	25%	36%	45%	15%		5%	29%	50%	62%	18%		5%	29%	50%	62%	18%
plans, programs		4%	28%	51%	71%	18%		4%	26%	49%	71%	18%		4%	26%	46%	59%	17%		4%	26%	53%	87%	19%		4%	26%	53%	87%	19%
comm or intel	0%	9%	18%	18%	17%	11%	1%	11%	25%	31%	39%	16%	1%	10%	19%	24%	27%	13%	1%	11%	27%	32%	40%	16%	1%	11%	27%	32%	40%	16%
(group or wing) + (k or q)	5%	28%	56%	64%	65%	36%	2%	11%	28%	28%	28%	16%	2%	11%	28%	28%	28%	16%	2%	11%	28%	28%	28%	16%	2%	11%	28%	28%	28%	16%
majcom, air staff		5%	45%	66%	78%	24%	13%	44%	84%	93%	98%	54%	12%	30%	64%	78%	82%	42%	16%	56%	99%	100%	100%	63%	16%	56%	99%	100%	100%	63%
unified cmd, ojcs, osd		7%	36%	62%	69%	22%	0%	8%	37%	65%	78%	24%	0%	8%	31%	55%	63%	21%	0%	8%	37%	77%	93%	27%	0%	8%	37%	77%	93%	27%
other staff	0%	13%	33%	33%	34%	18%	6%	32%	64%	79%	83%	42%	4%	28%	55%	58%	63%	34%	4%	34%	70%	95%	100%	46%	4%	34%	70%	95%	100%	46%
command		2%	15%	58%	88%	16%		1%	10%	41%	71%	12%		1%	10%	41%	64%	12%		1%	10%	41%	72%	12%		1%	10%	41%	72%	12%
Share of officers with experience in each combination of missiles, space, and acquisition																														
missile only	63%	32%	17%	32%	31%	35%	46%	24%	18%	15%	13%	27%	42%	34%	28%	27%	25%	34%	25%	9%				10%	25%	9%				10%
space only	20%	6%	14%	11%	7%	11%	32%	10%	5%	1%	1%	13%	52%	34%	19%	13%	11%	32%	41%	2%				12%	41%	2%				12%
acquisition only	0%	0%	1%	1%	1%	1%	1%					0%	1%					0%	1%					0%	1%					0%
missile and acquisition		8%	9%	5%	4%	6%	1%	8%	6%	8%	8%	5%	1%	8%	8%	9%	9%	6%	1%	11%	1%	0%	0%	4%	1%	11%	1%	0%	0%	4%
space and acquisition		4%	14%	16%	12%	7%	3%	5%	8%	10%	11%	6%	2%	18%	26%	26%	28%	17%	2%	8%	1%	0%	0%	3%	2%	8%	1%	0%	0%	3%
missile and space	4%	44%	36%	20%	31%	30%	17%	37%	22%	21%	18%	25%	0%	1%	2%	4%	4%	1%	29%	57%	43%	34%	26%	41%	29%	57%	43%	34%	26%	41%
all three	0%	5%	10%	14%	13%	6%	0%	16%	41%	45%	50%	23%	0%	5%	17%	21%	22%	10%	0%	13%	55%	66%	73%	30%	0%	13%	55%	66%	73%	30%
none of the three	12%	0%	0%	1%		3%	1%					0%	1%					0%	1%					0%	1%					0%
Other summary measures																														
avg experience categories	2.7	4.1	5.7	6.6	7.3	4.6	2.4	4.0	6.2	7.6	8.6	4.8	2.2	3.4	5.3	6.5	7.2	4.1	2.5	4.3	6.8	8.4	9.6	5.2	2.5	4.3	6.8	8.4	9.6	5.2
no. of profiles	18	190	337	241	102	588	20	101	139	150	108	295	22	104	126	110	116	263	23	109	89	76	41	212	23	109	89	76	41	212
% of all demand points met	-	-	61%	63%	72%	63%	-	-	99%	100%	100%	99%	-	-	99%	100%	100%	99%	-	-	99%	100%	100%	99%	-	-	99%	100%	100%	99%
% jobs (w demand) fully covered	-	-	48%	38%	37%	44%	-	-	95%	99%	100%	97%	-	-	95%	99%	100%	97%	-	-	95%	99%	100%	97%	-	-	95%	99%	100%	97%
avg selectivity for jobs w demand	-	-					-	-					-	-					-	-					-	-				
<div><div></div>if bigger by 20%</div> <div><div></div>if smaller by 20%</div> <div>(2001 % must be at least 10%)</div>																														

Table G.1—Continued

							Illustrative alternatives for the future*													
2001's 13S core officers							Case 4: demand both ops and acquisition experience for all command jobs							Case 5: weaponize space, civilianize some support activities						
	O-1/2	O-3	O-4	O-5	O-6	Total	O-1/2	O-3	O-4	O-5	O-6	Total	O-1/2	O-3	O-4	O-5	O-6	Total		
total officers	729	1,343	787	421	156	3,436	929	1,003	760	484	166	3,342	1,014	1,156	913	566	192	3,841		
No. of officers with experience in each category																				
missile	489	1,204	554	299	125	2,671	429	503	433	283	97	1,745	378	475	414	293	99	1,660		
space	177	790	578	258	100	1,903	475	572	502	321	113	1,984	612	735	639	398	138	2,523		
missile or space	637	1,334	776	413	155	3,315	900	990	760	484	166	3,300	990	1,154	913	566	192	3,815		
acquisition	2	228	266	152	47	695	14	266	424	333	119	1,157	42	331	450	329	123	1,276		
requirements	1	108	179	99	35	422		52	186	174	73	486		56	271	262	111	701		
plans, programs		58	222	215	111	606		47	201	223	100	571		60	250	291	155	756		
comm or intel	2	118	142	75	27	364	11	119	186	147	55	518	7	97	199	163	69	535		
(group or wing) + (k or q)	37	371	442	270	102	1,222	21	112	215	141	48	537	22	130	267	170	58	646		
majcom, air staff		71	355	276	122	824	115	348	540	390	139	1,532	193	514	882	565	192	2,346		
unified cmd, ojs, osd		91	285	259	107	742	1	76	289	339	131	835	1	85	313	411	171	981		
other staff	1	172	262	140	53	628	25	295	456	322	116	1,214	41	318	529	437	164	1,488		
command		33	120	244	138	535		6	75	193	104	378		13	110	254	145	522		
No. of officers with experience in each combination of missiles, space, and acquisition																				
missile only	460	435	131	134	49	1,209	422	343	172	96	32	1,065	360	318	189	115	38	1,021		
space only	148	82	108	45	11	394	462	356	117	42	12	989	601	493	248	99	22	1,463		
acquisition only	1	5	10	4	1	21	1	6				8	13	1				14		
missile and acquisition		109	67	21	6	203	3	74	86	68	21	252	18	100	84	53	16	271		
space and acquisition		48	114	69	19	250	10	131	210	159	57	567	11	185	251	174	70	691		
missile and space	28	594	281	86	49	1,038	3	30	47	14	3	97		12	25	24	8	69		
all three	1	66	75	58	21	221		56	129	106	41	332		45	115	102	38	299		
none of the three	91	4	1	4		100	27	7				34	11	1				12		
Share of officers with experience in each category																				
missile	67%	90%	70%	71%	80%	78%	46%	50%	57%	58%	58%	52%	37%	41%	45%	52%	52%	43%		
space	24%	59%	73%	61%	64%	55%	51%	57%	66%	66%	68%	59%	60%	64%	70%	70%	72%	66%		
missile or space	87%	99%	99%	98%	99%	96%	97%	99%	100%	100%	100%	99%	98%	100%	100%	100%	100%	99%		
acquisition	0%	17%	34%	36%	30%	20%	2%	27%	56%	69%	72%	35%	4%	29%	49%	58%	64%	33%		
requirements	0%	8%	23%	24%	22%	12%		5%	25%	36%	44%	15%		5%	30%	46%	58%	18%		
plans, programs		4%	28%	51%	71%	18%		5%	26%	46%	60%	17%		5%	27%	51%	81%	20%		
comm or intel	0%	9%	18%	18%	17%	11%	1%	12%	24%	30%	33%	15%	1%	8%	22%	29%	36%	14%		
(group or wing) + (k or q)	5%	28%	56%	64%	65%	36%	2%	11%	28%	29%	29%	16%	2%	11%	29%	30%	30%	17%		
majcom, air staff		5%	45%	66%	78%	24%	12%	35%	71%	81%	84%	46%	19%	44%	97%	100%	100%	61%		
unified cmd, ojs, osd		7%	36%	62%	69%	22%	0%	8%	38%	70%	79%	25%	0%	7%	34%	73%	89%	26%		
other staff	0%	13%	33%	33%	34%	18%	3%	29%	60%	67%	70%	36%	4%	27%	58%	77%	86%	39%		
command		2%	15%	58%	88%	16%		1%	10%	40%	62%	11%		1%	12%	45%	76%	14%		
Share of officers with experience in each combination of missiles, space, and acquisition																				
missile only	63%	32%	17%	32%	31%	35%	45%	34%	23%	20%	19%	32%	36%	28%	21%	20%	20%	27%		
space only	20%	6%	14%	11%	7%	11%	50%	35%	15%	9%	7%	30%	59%	43%	27%	17%	12%	38%		
acquisition only	0%	0%	1%	1%	1%	1%	0%	1%				0%	1%	0%				0%		
missile and acquisition		8%	9%	5%	4%	6%	0%	7%	11%	14%	13%	8%	2%	9%	9%	9%	8%	7%		
space and acquisition		4%	14%	16%	12%	7%	1%	13%	28%	33%	35%	17%	1%	16%	27%	31%	37%	18%		
missile and space	4%	44%	36%	20%	31%	30%	0%	3%	6%	3%	2%	3%		1%	3%	4%	4%	2%		
all three	0%	5%	10%	14%	13%	6%		6%	17%	22%	25%	10%		4%	13%	18%	20%	8%		
none of the three	12%	0%	0%	1%		3%	3%	1%				1%	1%	0%				0%		
Other summary measures																				
avg experience categories	2.7	4.1	5.7	6.6	7.3	4.6	2.1	3.4	5.6	6.9	7.6	4.3	2.3	3.4	5.7	7.3	8.4	4.5		
no. of profiles	18	190	337	241	102	588	21	106	132	108	104	263	23	98	122	122	79	295		
% of all demand points met	-	-	61%	63%	72%	63%	-	-	99%	100%	100%	99%	-	-	99%	100%	100%	99%		
% jobs (w demand) fully covered	-	-	48%	38%	37%	44%	-	-	95%	98%	100%	96%	-	-	94%	97%	100%	96%		
avg selectivity for jobs w demand	-	-					-	-					-	-						

*Use optimization, ladders, and depth objectives

if bigger by 20%
 if smaller by 20%
 (2001 % must be at least 10%)